FISCAL YEAR 1986 DEPARTMENT OF ENERGY AUTHORIZATION

(Nuclear Fission R&D and Waste Management)

HEARINGS

BEFORE THE

SUBCOMMITTEE ON
ENERGY RESEARCH AND PRODUCTION

OF THE

COMMITTEE ON
SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

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1986 DEPARTMENT OF ENERGY AUTHORIZATION

WEDNESDAY, FEBRUARY 20, 1985

House of Representatives,
Committee on Science and Technology,
Subcommittee on Energy Research and Production,
Washington, DC.

The subcommittee met, pursuant to notice, at 8:33 a.m., room 2318, Rayburn House Office Building, Hon. Marilyn Lloyd (chairman of the subcommittee) presiding.

Present: Representatives Lloyd, Young, Stallings, Roe, Lundine, Valentine, Morrison, Fawell, Monson, and Barton.

Staff present: Dr. John V. Dugan, Jr., Nelson L. Milder, Ron Williams, Louis Ventre, Tim Peckinpaugh, Tom Weimer, and Julie Shisler.

Mrs. Lloyd. The Committee on Energy Research and Production will come to order.

Good morning to all of you. It is so nice to see so many old familiar faces in the audience this morning and to be here with my colleagues. Certainly, I am pleased to be here again today to chair the Energy Research and Production Subcommittee for my third term. That is pretty nice, as well.

However, I do wish that the budget situation which we are presented with offered the prospect for more pleasant circumstances for all of us. It is educational to note where the free market approach has gotten us in nuclear R&D. Since 1981, the program has been eroded to a very alarming degree. I am sympathetic to the Department to a certain extent, but I really must indicate my impatience to a certain extent with DOE's approach to both the nuclear fission and the magnetic fusion research and development programs.

I really don't see the aggressive movement which we expected from DOE in focusing or moving the nuclear fission research and development program. My perspective, which is framed by my policy priorities, is rather straightforward. If you remember, this subcommittee laid out several areas of primary interest in our fiscal 1985 budget review process. I believe that there is an overwhelming full committee consensus to move ahead in these areas which we outlined, which the chairman and I outlined.

Unfortunately, the Department does not seem to be as goal-oriented as the committee had hoped when we identified these thrusts and these new challenges in the 98th Congress. Certainly, I am well aware of the budget deficit and resulting fiscal constraints that we find ourselves in. However, I don't think that these circumstances justify continued large reductions in the Nuclear Fission Program, already down 40 percent from our 1984 level.

I am afraid that I detect some confusion on DOE's part with respect to the Modular High Temperature Gas-Cooled Reactor Program which Mr. Fuqua and I identified as a top priority back in November 1983. This committee supported that initiative in a very bipartisan fashion in the second session of the 98th Congress. However, I don't think we can allow the Department's descriptions of concept or reference design to muffle our desire for a really aggressive program. The technical community has recently agreed upon an MHTGR configuration for a focus, so the program's budget justification is now moot.

I must admit that we are pleased with the redirection of the Breeder Base Technology Program to support innovative liquid metal reactor concepts. Yet, I am still somewhat troubled by the Department's muddying the water in terms of when the technology will actually be validated for MHTGR's or LMR's. I believe that these two machines are tailored to fit different needs. The MHGTR has a clear, potential role as a successor to today's LWR's in the 1990's and beyond, while the LMR technology, should be developed through some innovative designs to serve as a transitional breeder by about the year 2000. It also troubles me that there appears to be a lack of policy direction, a lack of goals, for the nuclear program, and I am not certain that, even though we will have a new Assistant Secretary, that it is necessary and is a sufficient solution to this problem.

Finally, I have a great interest in the Space Nuclear Power Program. This committee has historically been concerned about seeing that NASA will have the tools to carry out tomorrow's space program as well as current activities. I am also most interested in having this space nuclear technology development prove to be of great benefit to DOD's strategic defense initiative, and I intend to pursue this through oversight activities once the authorization cycle is complete. We believe that space station planners should be very ambitious and demand that high-power sources be developed now so that the NASA missions of the late 1990's and beyond are not limited by the availability of power.

In summary, the subcommittee and the committee have fulfilled the major responsibility of an authorizing committee, that is, to provide policy guidance for the Department's programs under the jurisdiction of this subcommittee. We do not intend to micromanage, but we must be assured that DOE is managing these efforts. I do fervently hope that oversight of these programs will not be as demanding in the future as they have in the past.

The Nuclear Fission R&D program is the topic for today's hearing and we shall cover the Nuclear Waste Program and Uranium Enrichment Programs in subsequent hearings. I am afraid that I am really not happy about the across-the-board cuts in these programs. Although I remain a staunch advocate of nuclear power, I am also determined that it will not be the victim of well-intentioned but unfortunate efforts of its friends to preserve the option.

Before we hear from Mr. Vaughan, and I had a nice visit with Mr. Vaughan late yesterday afternoon and I am looking forward to working with you and Dr. Wilcox as well, I do want to extend a very warm welcome to the new ranking Republican member of the subcommittee. He is one of my very great friends in this body, the Honorable Sid Morrison, who is from the State of Washington. I count him not only a staunch and articulate advocate of these R&D programs but a good friend and very respected associate in this House. Mr. Morrison, this is your great welcome and we are just tickled to death that you are here.

[The prepared statement of Mrs. Lloyd follows:]

HON. MARILYN LLOYD
FY 1986 DOE AUTHORIZATION HEARING
NUCLEAR FISSION OVERVIEW, CIVILIAN REACTOR DEVELOPMENT PROGRAM, & ADVANCED NUCLEAR SYSTEMS

FEBRUARY 20, 1985

GOOD MORNING. I AM PLEASED TO BE HERE AGAIN AND CHAIRING THE ENERGY RESEARCH AND PRODUCTION SUBCOMMITTEE FOR MY THIRD TERM. HOWEVER, I WISH THAT THE BUDGET SITUATION WHICH WE ARE PRESENTED WITH OFFERED THE PROSPECT OF MORE PLEASANT CIRCUMSTANCES. IT IS EDUCATIONAL TO NOTE WHERE THE "FREE MARKET" APPROACH HAS GOTTEN US IN NUCLEAR R&D. SINCE 1981, THE PROGRAM HAS BEEN ERODED TO AN ALARMING DEGREE. I AM SYMPATHETIC TO THE DEPARTMENT TO A CERTAIN EXTENT, BUT I MUST INDICATE MY IMPATIENCE WITH DOE'S APPROACH TO BOTH THE NUCLEAR FISSION AND MAGNETIC FUSION RESEARCH AND DEVELOPMENT PROGRAMS.

I DON'T SEE THE AGGRESSIVE MOVEMENT WHICH WE EXPECTED FROM THE DOE IN TERMS OF FOCUSING OR MOVING THE NUCLEAR FISSION R&D PROGRAM. MY PERSPECTIVE, WHICH IS FRAMED BY MY POLICY PRIORITIES, IS RATHER STRAIGHTFORWARD. THIS COMMITTEE LAID OUT SEVERAL AREAS OF PRIMARY INTEREST IN THE FY 1985 BUDGET REVIEW PROCESS AND I BELIEVE THAT THERE IS AN OVERWHELMING COMMITTEE CONSENSUS TO MOVE AHEAD IN THOSE AREAS. UNFORTUNATELY, THE

DEPARTMENT DOES NOT SEEM TO BE AS GOAL-ORIENTED AS THE COMMITTEE HAD HOPED WHEN WE IDENTIFIED THESE THRUSTS IN THE 98TH CONGRESS. I AM WELL AWARE OF THE SIZE OF THE BUDGET DEFICIT AND THE RESULTING TIGHT FISCAL CLIMATE IN WHICH WE FIND OURSELVES. HOWEVER, I DO NOT THINK THESE CIRCUMSTANCES JUSTIFY CONTINUED LARGE REDUCTIONS IN THE NUCLEAR FISSION PROGRAM, ALREADY DOWN 40% FROM FY 1984.

I'M AFRAID I DETECT SOME OBFUSCATION ON DOE'S PART WITH RESPECT TO THE MODULAR HIGH TEMPERATURE GAS-COOLED REACTOR (MHTGR) PROGRAM, WHICH MR. FUQUA AND I IDENTIFIED AS A TOP PRIORITY BACK IN NOVEMBER OF 1983. THIS COMMITTEE SUPPORTED THAT INITIATIVE IN A BI-PARTISAN FASHION IN THE SECOND SESSION OF THE 98TH CONGRESS. HOWEVER, I DON'T THINK WE CAN ALLOW THE DEPARTMENT'S DESCRIPTIONS OF "CONCEPT" OR "REFERENCE DESIGN" TO MUFFLE OUR DESIRE FOR AN AGGRESSIVE PROGRAM. THE TECHNICAL COMMUNITY HAS RECENTLY AGREED UPON AN MHTGR CONFIGURATION FOR A FOCUS, SO THE PROGRAM'S BUDGET JUSTIFICATION IS NOW MOOT.

I MUST ADMIT THAT WE ARE PLEASED WITH THE REDIRECTION OF THE BREEDER BASE TECHNOLOGY PROGRAM TO SUPPORT INNOVATIVE LIQUID METAL REACTOR CONCEPTS. YET, I AM STILL SOMEWHAT TROUBLED BY THE DEPARTMENT'S "MUDDYING THE WATER" IN TERMS OF WHEN THE TECHNOLOGY WOULD ACTUALLY BE VALIDATED FOR MHTGRS OR LMRS. I BELIEVE THAT THESE TWO MACHINES ARE TAILORED TO MEET DIFFERENT NEEDS; THE MHTGR HAS A CLEAR, POTENTIAL ROLE AS A SUCCESSOR TO TODAY'S LWRS IN THE 1990'S AND BEYOND, WHILE THE LMR TECHNOLOGY SHOULD BE

DEVELOPED THROUGH SOME INNOVATIVE DESIGN TO SERVE AS A TRANSITIONAL BREEDER BY ABOUT THE YEAR 2000. IT ALSO TROUBLES ME THAT THERE APPEARS TO BE A SIGNIFICANT LACK OF POLICY DIRECTION FOR THE NUCLEAR PROGRAM AND I AM NOT CERTAIN THAT THE APPOINTMENT OF A NEW ASSISTANT SECRETARY, IF THAT IS EVEN IMMINENT, IS A NECESSARY AND SUFFICIENT SOLUTION TO THE PROBLEM.

FINALLY, I HAVE A GREAT INTEREST IN SPACE NUCLEAR POWER AND THIS COMMITTEE HISTORICALLY HAS BEEN CONCERNED ABOUT SEEING THAT NASA WILL HAVE THE TOOLS TO CARRY OUT TOMORROW'S SPACE PROGRAM AS WELL AS CURRENT ACTIVITY. I AM ALSO MOST INTERESTED IN HAVING THIS SPACE NUCLEAR TECHNOLOGY DEVELOPMENT PROVE OF GREAT BENEFIT TO THE DOD'S STRATEGIC DEFENSE INITIATIVE (SDI) AND INTEND TO PURSUE THIS ISSUE THROUGH OVERSIGHT ACTIVITY ONCE THE AUTHORIZATION CYCLE IS COMPLETE. WE BELIEVE THAT SPACE STATION PLANNERS SHOULD BE AMBITIOUS AND DEMAND THAT HIGH POWER SOURCES BE DEVELOPED NOW SO THAT THE NASA MISSIONS OF THE LATE 1990S AND BEYOND ARE NOT LIMITED BY THE AVAILABLE POWER.

IN SUMMARY, THE SUBCOMMITTEE AND COMMITTEE HAVE FULFILLED THE MAJOR RESPONSIBILITY OF AN AUTHORIZING COMMITTEE, THAT IS, TO PROVIDE POLICY GUIDANCE FOR THE DEPARTMENT'S PROGRAMS UNDER ITS JURISDICTION. WE DO NOT INTEND TO MICRO-MANAGE, BUT WE MUST BE ASSURED THE DOE IS MANAGING THESE EFFORTS. I FERVENTLY HOPE THAT OVERSIGHT OF THESE PROGRAMS WILL NOT BE AS DEMANDING IN THE FUTURE AS IT HAS BEEN IN THE PAST.

THE NUCLEAR FISSION R&D PROGRAM IS THE TOPIC FOR TODAY'S HEARING AND WE SHALL COVER THE NUCLEAR WASTE PROGRAM AND URANIUM ENRICHMENT ACTIVITIES IN SUBSEQUENT HEARINGS. I AM AFRAID THAT MY DISCOMFORT EXTENDS ACROSS THE BOARD IN THESE PROGRAMS AND, ALTHOUGH I REMAIN A STAUNCH ADVOCATE OF NUCLEAR POWER, I AM ALSO DETERMINED THAT IT WILL NOT BE A VICTIM OF WELL-INTENTIONED BUT UNFORTUNATE EFFORTS OF ITS FRIENDS TO PRESERVE THE OPTION.

BEFORE WE HEAR FROM MR. VAUGHAN AND DR. WILCOX, I WANT TO EXTEND A WARM WELCOME TO THE NEW RANKING REPUBLICAN MEMBER OF THE SUBCOMMITTEE, THE HONORABLE SID MORRISION, FROM THE STATE OF WASHINGTON. I COUNT HIM NOT ONLY AS A STAUNCH AND ARTICULATE ADVOCATE OF THESE R&D PROGRAMS, BUT AS A GOOD FRIEND AND MOST RESPECTED ASSOCIATE IN THIS HOUSE. MR. MORRISON.

Mr. MORRISON. Thank you, Madam Chairman. I have been trying for 4 years to at least even sit at the far end of the dais.

Mrs. LLOYD. And we have been trying to get you here, too.

Mr. MORRISON. Good morning. I am delighted to help the chairman kick off these authorization hearings on the Department of Energy's civilian energy research and development programs. I have watched the actions of this subcommittee from the outside for 4 years. I have been impressed with the subcommittee's foresight and expertise. The investment you have made in our energy future will reap handsome benefits for our children and grandchildren. Because of this, I am delighted to join the subcommittee as the new ranking Republican and look forward to the challenge of developing a DOE authorization budget.

This fiscal year offers us a challenge. The budget is extremely tight and we must all adhere to strict concepts of fiscal responsibility and austerity in the budget process. However, we must also continue essential nuclear fission programs upon which future economic growth depends.

We are faced with some difficult choices, not the least of which is the Breeder Reactor Development Program. The proposed cuts in the administration budget for advanced breeder reactor technology amount to nearly 18 percent over last year and nearly 50 percent over 2 years. The cuts will be tragic in terms of lost manpower, foregone technology, and a further erosion of our credibility and leadership in nuclear matters abroad. At the Hanford Engineering Development Laboratory alone, the loss in skilled talent could be 300 to 400 jobs.

These cuts will mean that we can run our test facilities, EBR-II and the Fast Flux Test Facility, but without a technology component. This undermines the technical utility of the entire program. The more important question is, "what happens next year?" If we sustain cuts next fiscal year comparable to what the administration is proposing this year, the continued operation of the FFTF is clearly imperiled.

This facility has had an unparalleled operating success and has been reaching new milestones and setting world records every month. I believe the Department needs to make a long-term commitment to run this facility, the crown jewel of our nuclear fission R&D Program. Without a definitive decision on the future of the FFTF, our breeder reactor program will lack direction and a focused mission. I will be most interested in the comments from the administration on the continued operation of our breeder reactor test facilities.

I am also interested in the new advanced nuclear applications, particularly opportunities for the space station, SP–100, and terrestrial reactors. In addition, I share the subcommittee's enthusiasm for the development of new modular reactors with standardized designs, factory fabrication, and inherent and passive safety systems.

The nuclear option, Madam Chairman, must be preserved. Through the further leadership, dedication, and creative initiatives of this subcommittee, I sincerely hope that we can enhance the viability of nuclear power in our and in our children's energy future, and I look forward to working with you toward that goal.

[The prepared opening statement of Mr. Morrison follows:]

OPENING STATEMENT OF THE HONORABLE SID MORRISON ON THE FY 1986 DOE AUTHORIZATION REQUEST FOR NUCLEAR FISSION PROGRAMS

Subcommitee on Energy Research and Production

February 20, 1985

Good morning. I'm delighted to help the Chairman kick-off these authorization hearings on the Department of Energy's civilian energy research and development programs. I have watched the actions of this Subcommittee for four years and I have been impressed with the Subcommittee's foresight and expertise. The investment you have made in our energy future will reap handsome benefits for our children and grandchildren. Because of this, I'm delighted to join the Subcommittee as the new Ranking Republican and look forward to the challenge of developing a DOE authorization budget.

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We are faced with some difficult choices, not the least of which is the breeder reactor development program. The proposed cuts in the Administration budget for advanced breeder reactor technology amount to 18 percent over last year and nearly 50 percent over two years. The cuts will be tragic in terms of lost manpower, foregone technology, and a further erosion of our credibility and leadership in nuclear matters abroad. At the Hanford Engineering Development Laboratory alone, the loss in skilled talent could be 300-400 jobs.

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Mrs. Lloyd. Thank you very much, Mr. Morrison.

Now we will hear from the Department of Energy, Mr. Vaughan and Dr. Wilcox. Welcome, today. Your complete written statement, Mr. Vaughan, will be entered in the record, so you can summarize your testimony or proceed any way that you wish. We welcome you, and please proceed.

STATEMENT OF JAMES W. VAUGHAN, JR., ACTING ASSISTANT SECRETARY FOR NUCLEAR ENERGY, DEPARTMENT OF ENERGY; ACCOMPANIED BY DR. LYLE WILCOX, DEPUTY ASSISTANT SECRETARY FOR BREEDER REACTOR PROGRAMS; STEVE LANES; HOWARD ROHM; AND DR. DEL BUNCH

Mr. Vaughan. Thank you very much, Madam Chairman and members of the subcommittee. I am indeed pleased to be here with you today to discuss the Department's Civilian Reactor Development and Advanced Nuclear System Programs.

As you know, our total funding request for these programs in fiscal year 1986 is $370 million in budget authority, as compared to $415 million last year. The numbers are in the tables in the statement and in detailed budget information.

You have laid out in your opening remarks a menu that is not dissimilar to mine, and we will attempt to address as many of those items in as much detail as we can with you today.

Since this is my first appearance before this subcommittee acting in my current capacity, I would like to make a brief personal comment before proceeding with my overview.

As many of you know, my background includes over 25 years of experience in the Naval Nuclear Propulsion Program, including 5 years as Deputy Director. A large part of the growth and development of the civilian nuclear industry in this country evolved from the technical base that was begun in that program. In fact, the first electricity produced for civilian use by nuclear energy was a project of that program, the Shippingport Atomic Power Station.

In many cases, the Civilian Nuclear Power Program, both Government and industry, have carried over the principles that made that Navy Nuclear Power Program so successful, but in other cases we have not done so well. Therefore, I think it is important for you to understand at the outset there are three guiding principles that do influence my professional responsibility for the Department's civilian nuclear energy programs.

The first is that the continuing development and application of nuclear energy must be done on a technically sound basis. Decisions and commitments must first and foremost be based on doing what is right technically. We just simply can't afford to make mistakes or mortgage our future through any unsound technical decisions.

Second, we must ensure that we protect the health and safety of the public and our environment. Third, we are indeed stewards of the public's money, trust, and future, and we must treat it as if it were our own.

These principles are really inherent in the decisions and the thrusts being made in the program that we are going to discuss together today.

One of the national policy issues on which I think there is nearly unanimous agreement is our need for continued economic growth. With even this present rate of growth, our industrial economy may lose its competitive edge unless we have significant new generating capacity available in the 1990's.

It is clear, and I think we are all in agreement, that nuclear energy should remain an essential element in the national policy goal to provide a balanced, diverse source of energy supply at reasonable cost. Coal and uranium are our two principal indigenous energy resources for competitive electricity production, and both will be needed to meet this goal in the long-term.

As we are all well aware, nuclear energy is playing a prominent role, currently providing over 13 percent of the electricity consumed in the United States and having the potential to supply about 20 percent of our electricity consumption by 1990 if all the plants that are currently under construction are completed. As you all know, this will represent an investment of several hundred billion dollars.

The other side of the coin is indeed disappointing, and you all know it well. There have been no orders for nuclear reactors since 1978, and the utilities have cancelled 115 orders for nuclear plants since 1972. So, our position of technical leadership and the ability of U.S. industrial suppliers to compete in the international market are threatened. We are being viewed internationally as a less than fully reliable trading partner in an energy technology, nuclear power, that is a U.S. invention.

The nuclear option is in serious danger of being foreclosed, despite the fact that over the past 25 years nuclear power has proven to be a reliable, economical, and environmentally acceptable provider of electricity; and despite the fact that nuclear power has a very good safety record, better than most other major sources of electrical energy, if not all other sources.

So, how have we arrived at this dichotomy, this alarming juncture? I think a key factor, as we all know, is that nuclear powerplants have become unacceptable economic risks that discourage private investment. These are due primarily to an unpredictable licensing process, construction delays, and high capital costs, despite the fact that, indeed, we have a reliable technology by all normal standards.

So, some people have suggested that we just take the technology and go put it on the shelf and use it some day when we need it in the future. I think, and I think this subcommittee shares my views, my strong personal views that there are several cogent reasons why this is not the proper course from a national perspective.

The first is that the current technology, as good as it is, must be augmented to meet the intermediate and longer term needs of the Nation. Our large light-water-cooled nuclear powerplants, as good as they are, represent capital investments that are too great for some utilities. Their control and safety systems are complex. Their construction is expensive and lengthy. In the decade of the 1990's, in addition to our industries' most advanced versions of large LWR's, a new generation of advanced light-water-cooled reactors, high-temperature gas-cooled reactors and liquid-metal-cooled reactors, embodying the best of high technology, should be available to enable the nuclear industry to provide utilities and other users with less expensive, more quickly constructed sources of power with improved economics and enhanced passive safety features.

Beyond the year 2000, we do need to extend our uranium resources. That will require the continued use of advanced converter reactors and the introduction of breeder reactors. It is for these reasons, with these premises, this menu, that we have restructured our development program to assure retention of nuclear power as a viable technical and economic option for consideration by the marketplace, a marketplace in which Government and industry must work together in their respective roles.

A second reason why we can't put nuclear technology on the shelf is that the same institutional impediments that are currently inhibiting private investment will continue in the future unless we actively and cooperatively seek solutions today. Chief among these impediments is the unpredictable and lengthy licensing process which costs the utilities and, eventually, the ratepayers, millions of dollars annually. Again this year, the Department does plan to submit comprehensive licensing reform legislation aimed at helping remedy this situation without compromising the assurance of public health and safety. I know that is an area that is of interest to many of you, but that is another subject for another day.

Third, even the best of technologies cannot be utilized without the industrial infrastructure and skilled personnel necessary to make it work. Unless we make some changes soon to facilitate the ordering and licensing of commercial nuclear plants, the capability of the United States to produce high-quality reactors will diminish significantly, and the supply of highly skilled nuclear scientists, engineers, educators, and technicians will dwindle. Simply stated, we must make the nuclear option again viable if the R&D programs that we are here to talk about are to have the chance to bear even riper fruit.

We need a continued, cooperative effort among the nuclear industry, the utilities, and the Government for the purpose of completing the design of advanced plants using state-of-the-art technology and obtaining certification of those designs. This, coupled with a predictable and stable licensing and regulatory process, would permit the utilities to order standard or fixed design plants suitable for multiple site applications, with reasonable economic risk. Then, if the plant is built to specifications, it could be operated without undue delay and, thereby, reduce the costs on invested capital.

DOE's role in this effort would be that of a catalyst, not an investor or subsidizer, to foster a concerted effort to ensure that nuclear power will be a viable option for the market now and in the future. Our mutual goal needs to be an environment in which the private sector would be willing to order an advanced design nuclear powerplant by about 1990 or so.

There are a number of paths to achieve that objective. The so-called advanced LWRs currently being designed by the U.S. nuclear industry in conjunction with foreign partners for licensing and deployment overseas offer an excellent near-term opportunity to begin solving many of the problems I have described. Much of the requisite technology exists from over 30 years of experience. Several proposed designs provide greater tolerance to abnormal events and, thus, longer operator response times without unacceptable safety risks. Our efforts will concentrate on stimulating industry to transform these designs into reality and to seek cooperative solutions to many of the institutional problems that beset the industry.

In parallel, we do plan to pursue a continuum of development of advanced nuclear fission technology for the future. History teaches us that effective use and application of any basic technology requires both continuing deployment and experience concomitantly with focused research and development to enable these future improvements. The Department has an historic and valid role in nuclear safety research as well as in the enabling of advanced nuclear technologies.

If I go back to my naval experience, what we must do is really continue to "launch the submarines," and keep a continuum of R&D going in parallel to make them better and not quite change them every year or every hour like we have done some of the nuclear powerplants in this country.

With this background, I would like to briefly describe the Department's reactor development programs that address these problems. We have recently prepared a civilian reactor development program document that will address in more detail many aspects of the program, and we will be providing that document formally to interested congressional committees in the near future. We have already informally provided copies to the staff. Your comments on that strategy as well as those from other interested parties will be welcome.

The cancellation of the Clinch River Breeder Reactor Project, as unpleasant as it was for many of us, has afforded the Department a good opportunity to reshape our nuclear research and development programs. In so doing, we have tried to take the best elements of our existing programs and refocus our efforts more on the near and intermediate term needs of the country. We have tried to work very closely with EPRI, with the utilities, and with the reactor manufacturers and interested user groups to forge common goals and objectives. I know you will be hearing from a number of those people tomorrow.

One feature of our program is increased emphasis on international collaboration. Sharing our operating experience, research results, and facilities with our technical partners overseas could result in safer and more economical nuclear systems and will help restore credibility of the United States as a nuclear trading partner as well as strengthen our position in international commerce.

I also believe that effective nuclear nonproliferation progress requires that the United States must remain a major, reliable, and credible international supplier of nuclear fuels, services, and equipment. Our influence over other nations in the use and control of nuclear materials will be sharply limited if we cease to maintain our professional and technical leadership in nuclear power.

I turn now to a few of the specific program elements. The improved LWR technology program is directed at performing generic research and development, building on our current designs that requires long-term effort using the unique capabilities of government facilities, and also performing research and development associated with the recovery from the accident at Three Mile Island. As you know, the Department is continuing to apply its unique experience and technical resources to the efforts at Three Mile Island. In return, the experience that we gain and the technology that we develop we believe will be of generic benefit to the Government and to the entire nuclear industry.

TMI represents a wonderful opportunity out of a bad experience—to understand the nature of a core that came very close to melted and probably did have melting in some parts and yet did not disperse fission products nearly as far within the containment nor outside the containment as people would have anticipated, and is a good lesson in the fact that our safety systems did, in fact, protect the health and safety of the public. So, we are learning a lot of good things out of a bad experience.

Our fiscal year 1986 efforts will include continuing examination of portions of that core at a DOE laboratory as well as activities to help remove the fuel that has gone below the level of the core, as I am sure most of you have read in the newspapers.

The Advanced Converter Reactor Technology Program is a key element of our technological efforts. The program includes work on three principal nuclear systems: advanced or innovative light-water-cooled reactors, liquid-metal-cooled reactors, and the high-temperature gas-cooled reactors that are of interest to a number on this committee.

Work in all three of these systems does have a common set of objectives: To improve system economics, to develop passive safety features, to increase the tolerance to abnormal events, to shorten construction times, and to facilitate licensing.

We feel we need to marry the very best of our industrial technology with improved reactors in varying size ranges if we are to foster a revitalization of the nuclear option. Each of these reactor types has the potential to do just that. In fact, we must do it if we are to have a secure, diverse energy source to meet our needs beyond 1990.

Technology for the next generation of water-cooled reactors will be pursued in close cooperation with industry. We intend to evaluate proposed advanced LWR concepts and assess passive safety features with the potential for reducing licensing related delays in construction. Our focus will be to select and complete a conceptual design of a small- to medium-sized LWR that utilizes state-of-the-art technology and innovative features to overcome many of the current problems. Emphasis will be placed on standardized designs, increased factory fabrication, reduced cost and licensing time, enhanced safety margins, and improved reliability.

I think it is fair to say these themes will proceed throughout the total program.

In the area of liquid-metal-cooled converter reactor technology, we have already taken the first steps toward innovative design approaches. We have selected two U.S. design organizations to work under contract to DOE to develop advanced concepts for smaller, modular liquid-metal-cooled reactors of less than 300 MWe output that do offer some of the same advantages of more complete factory fabrication, ease of shipment, and the same features I described above. We anticipate that the relatively detailed conceptual designs being developed in this 3-year effort will provide a good focal point for this program element and will help focus our related research and development work.

The high-temperature gas-cooled reactors are indeed ones which have a variety of unique and attractive features which can provide greater safety margins and larger investment protection margins. Additionally, they do have the potential to meet industrial requirements for process heat as opposed to electricity generation. During 1985, we will complete the selection of the reference small HTGR concept. It does, indeed, appear that consensus is emerging on a modular side-by-side design, and most of the effort in the remainder of the year will be focused on that conceptual design so that we can proceed apace with this program within the budget constraints that we have.

We do intend to expand the international HTGR Program, including our cooperative arrangements with the Federal Republic of Germany and some additional cooperative programs with Japan which are well underway.

In the area of advanced breeder reactor technology, as you know, we have significantly restructured this program. We currently have no funding directed toward large-scale demonstration projects, and we have the program funded and paced to maintain the breeder as a viable option for deployment in the 21st century.

This current program does remain a key link with significant international breeder development and fuel cycle programs, particularly in Japan, France, and Germany, and the United Kingdom to some degree. These nations are moving toward the deployment of breeder reactors on an earlier timetable than we are because of their differing energy supply circumstances. As you know, this gives us a unique challenge as well as a unique opportunity.

The challenge is to further international nonproliferation goals, goals for which we maintain a leading role even though we are no longer leading the deployment of breeder technology. Our opportunity is one of being able to capitalize on our past experience of resources and our technology leadership in reactor fuels and materials to obtain counterbalancing overseas operating experience, and thus help reduce future expenditures while maintaining a viable, active breeder option.

The objective of the water-cooled breeder reactor program, as you know, is to develop technology that will improve the efficiency of our nuclear fuel resource utilization. I think you are well aware that the activities in 1986 are a continuation to bring that program to a pause point by examining and evaluating selected fuel elements from that core for proof of breeding purposes.

I think what we have said so far is that nuclear energy must continue to be an important component of the Nation's balanced and mixed energy supply system. We have to be prepared to offer the marketplace a nuclear option that is safe, technically sound, and publicly accepted with a stable and predictable licensing and regulatory process. Our programs are structured to ensure that there will be a variety of safe and economical reactors and fuel cycle technologies including advanced light-water-cooled reactors, advanced HTGR's, liquid-metal-cooled converter reactors, and the technology for advanced breeder reactors, so that industry can select the best options to meet needs that we can't entirely predict today.

Attainment of these objectives is a prerequisite to realizing the benefits of our investment in past, present, and future research and development efforts. I hope that the economic well-being and security of the Nation can benefit from our efforts if we collectively work together to achieve these objectives.

I would now like to turn briefly to describe our advanced nuclear systems program and comment briefly on some other activities of interest——

Mrs. LLOYD. May I interrupt you just 1 minute?

Mr. VAUGHAN. You certainly may.

Mrs. LLOYD. On the bottom of page 15, where you say, "to offer the marketplace a nuclear option," for the record, would you like to phrase that, "that continues to be safe, technically sound," so that no one would infer that we haven't had a safe technology? I think that is what you meant——

Mr. VAUGHAN. Where are you, Madam Chairman?

Mrs. LLOYD. On the bottom of page 15.

Mr. VAUGHAN. We clearly want to offer the marketplace an option that continues to be safe, technically sound, and publicly accepted. Absolutely.

Mrs. LLOYD. Thank you, sir. I knew that was what you meant.

Mr. VAUGHAN. As I indicated in my opening comments——

Mrs. LLOYD. I just didn't want you to be misunderstood, Mr. Vaughan.

Mr. VAUGHAN. I appreciate that, Mrs. Lloyd, because that is just an absolutely inherent premise in everything we do.

Mrs. LLOYD. Thank you very much, sir.

Mr. VAUGHAN. Thank you for catching that.

Now, let's turn for a moment to advanced nuclear systems and some other special related activities that are of particular interest to you and, I can also tell you, from my background, are of real interest to me. There are some programs here that Lyle Wilcox and I are very excited about for their near-term applications.

The advanced nuclear systems program supports civilian and military applications of nuclear energy in space exploration through the development of a range of power systems. The particular category is focused under that budget line on radioisotope thermoelectric generators. To date, the program has provided DOD and NASA with RTG's for a number of terrestrial missions as well as a power source for 23 successful space missions.

Mrs. LLOYD. Could I interrupt you one more time?

Mr. VAUGHAN. You certainly may.

Mrs. LLOYD. Since we have new members on the committee, could you explain in a little more detail the RTG's program? Those are three big words.

Mr. VAUGHAN. Madam Chairman, what I was planning to do, if you would like, when I finish the statement, since we do have a number of new members and they have come, is we did bring with us a number of Vu-Graphs and we would be glad to lay those on the screen to help with that.

Mrs. LLOYD. All right. That is very good.

Mr. VAUGHAN. And I was going to offer to do that.

Mrs. LLOYD. Thank you. I appreciate that. I don't want any of our members to feel threatened by any of our big words and our acronyms.

Mr. VAUGHAN. Neither do we. Simply stated, radioisotope thermoelectic generators are high-powered nuclear flashlights, up to 500 watts, that can provide a power source for a number of missions needing small amounts of power. They are not a dynamic reactor, as such. We can talk about a few of those in a minute. You have basically a nuclear flashlight or nuclear battery of infinite lifetime compared to the length of those missions.

The goals for 1986 are to help in working very closely with NASA on the activities related to the Galileo and Ulysses spacecraft launches scheduled for 1986 and the continuation of environmental testing and safety studies. These are cornerstones of the Department's responsibilities, both the safety of the RTG's as well as to fabricate the components.

Some of you may know the Ulysses mission as the so-called international solar-polar mission having been renamed. Galileo and Ulysses will be launched in May and June of 1986 with a 10-day launch window, and that is probably the highlight of fiscal year 1986. We are going to complete the assembly and testing of these isotope power units, complete the safety documentation, and safety testing, and make sure that there is absolutely no environmental problem if we should have an accident before the thing reaches into space, which none of us hope for, want to, or predict.

Two of our other advanced special nuclear applications that are included in a decision unit within the budget called Defense Energy Programs but which also have civilian applications and are of particular interest to this committee are the SP-100 space reactor development effort and the north warning power project. In the early stages of the SP-100 program, it was unclear whether the eventual product would be a military or a civilian reactor. With the President's new strategic defense initiatives, it is likely that the first application will be for the military. It is also a potential application for the second, but not the first, NASA space station, as NASA has currently ordered their priorities.

These efforts do provide a wonderful and effective opportunity for cross-pollination of technology between both civilian and military missions, which is why we have them integrated in the nuclear energy part of the Department. It is kind of like a chicken and egg proposition. We need technology to enable missions. People with missions need the technology, and you have to have both in order to make the continuing research and development system effective.

With respect to the SP-100 program, the primary emphasis of that program, which was begun in 1983, has been to assess and confirm the feasibility, advance the technology, and demonstrate the technical readiness of a compact, lightweight, durable, and safe reactor power system in the 100 KWe class. I am now, for the new members, in a bigger class of power than I was with the small nuclear powered batteries, and we will show you some pictures on the screen here in a few minutes.

The SP-100 program had been planned as a three-phase program. This first phase focused on evaluating various concepts and establishing technical feasibility. The second phase will focus on a ground engineering system test of one concept selected at the conclusion of the first phase. The third phase, then, will move to the flight qualification phase when a specific mission commitment has been made.

We plan to complete this first phase, concept evaluation, in mid-1985 and select among three competing concepts, one for ground testing to begin in fiscal year 1986. We plan to select a site for that ground test at the same time the concept is selected.

The ground test program is one that is projected to require 5 to 6 years to complete. It is expected that progress will be sufficient to allow NASA or SDIO to make a flight commitment in the 1988-89 timeframe. When I say SDIO, I am also including the Air Force, generically, because it is quite likely that one of the first uses will be a low-orbit space-based radar system.

We also are working with the military and anticipate that the efforts that grow out of the SP-100 program can lead us to even larger power applications that will be needed in the multimegawatt range.

The last program I would mention is the north warning power project which you may have read about recently in the newspaper. There is a need for ground-based military power systems that can operate continuously in harsh environments with little or no attendance and freedom from the need for frequent replenishment of fuel supplies, such as diesel oil, or with the need for people to stay there and attend the stations. These systems, therefore, require high reliability, low maintenance, long life, and simplified logistics. At the request of the Air Force and in cooperation with the Air Force, the Atomic Energy of Canada, Ltd., we are jointly funding a program to demonstrate the feasibility of using a 15 KWe reactor power source for this north warning project to be used to power approximately 39 short-range radar sites associated with an upgrade of the distant early warning or the DEW line across northern Canada.

As you may be aware, the President is planning to sign an agreement with the Canadians in March for the upgrading of the DEW line. Both diesel powered and these reactor powered sources are candidates for powering those radar stations. Our target is to be able to place a demonstration reactor in ground testing by early 1987 and to be followed by one or two prototype reactors placed at designated north warning sites, enabling us to make a deployment decision as early as 1988.

Madam Chairman, this does conclude my opening statement. As you know, Dr. Wilcox, our Deputy Assistant Secretary responsible for planning and formulating the reactor and nuclear technology development programs that we have described, is here with me. We do have some Vw-Graphs which would help, particularly in these advanced nuclear systems and special space applications, available. We would be happy to proceed with doing a 3- or 4- to 10-minute tutorial. We would be happy to proceed to answer questions or any way you would like.

[The prepared statement of Mr. Vaughan follows:]

STATEMENT OF
JAMES W. VAUGHAN, JR.
ACTING ASSISTANT SECRETARY FOR NUCLEAR ENERGY
DEPARTMENT OF ENERGY
BEFORE THE
SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

FEBRUARY 20, 1985

Madam Chairman and Members of the Subcommittee, I am pleased to be here today to discuss the Department of Energy's Civilian Reactor Development and Advanced Nuclear Systems programs. Our total funding request for these programs in FY 1986 is $370.0 million in budget authority, as compared to the $414.8 million appropriated in FY 1985. The requested funds are distributed among the program elements as indicated in the following table:

	($ in Millions)		
Program Element	FY 1984 Actual	FY 1985 Appropriation	FY 1986 Request
Civilian Reactor Development			
Improved LWR Technology	$ 54.2	$ 50.3	$ 53.3
Advanced Converter Reactor Technology	55.3	109.3	105.2
Advanced Breeder Reactor Technology	276.9	171.8	141.3
Water-Cooled Breeder Reactor Technology ..	35.3	26.0	19.7
Civilian Reactor Development Support	49.6	29.6	30.5
Subtotal	471.3	387.0	350.0
Clinch River Breeder Reactor Project[1]	122.6	0	0
Advanced Nuclear Systems	29.0	27.8	20.0
Total	$ 500.3	$ 414.8	$ 370.0

I would like to provide an overview of the factors that have influenced the scope and content of the programs supported by our FY 1986 budget.

OVERVIEW

One of the national policy issues on which there is nearly unanimous agreement is the need for continued economic growth. An essential ingredient of economic growth is the availability of adequate energy at a reasonable cost. Over the past four decades, consumption of electric power has increased far more rapidly than the Gross National Product (GNP). With even the present rate of growth, our industrial economy may lose its competitive edge unless significant new generating capacity is made available in the 1990's.

It is clear that nuclear energy should remain an essential element in the national policy goal to provide a balanced, diverse source of energy supply at reasonable cost. Coal and uranium are our two principal indigenous energy resources for competitive electricity production, and both will be needed to meet this goal in both the near and long term.

Nuclear energy plays a prominent role in meeting this Nation's anticipated energy demands. It is a safe and reliable energy source, currently providing over 13 percent of the electricity consumed in the United States. In 1984, domestic nuclear powerplants generated more than 340 billion kilowatthours of electricity. There are 86 operable[1] commercial nuclear powerplants in the United States. By 1990, if all the plants currently under construction are completed, light-water-cooled reactors in this country will supply about 20 percent of our electricity consumption and will represent an investment of several hundred billion dollars.

The other side of the coin is disappointing. There have been no new orders for nuclear reactors since 1978, and the utilities have cancelled 115 orders for nuclear plants since 1972. The absence of additional orders means that the last operating nuclear powerplant in the United States could be shut down before the year 2030, based on currently estimated plant lifetimes. Our position of technical leadership and the ability of U.S. industrial suppliers to compete in the international market are threatened. Further, the United States is viewed internationally as a less than fully reliable trading partner in an energy technology that is a U.S. invention.

In short, the nuclear energy option is in serious danger of being foreclosed; despite the fact that over the past 25 years nuclear power has proved to be a reliable, economical, and environmentally acceptable provider of electricity; and despite the fact that nuclear power has a safety record unparalleled by any other major source of electrical energy.

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[1] An "operable" nuclear powerplant is one that has received the full-power amendment to its operating license and is allowed to operate at full power.

How have we arrived at this alarming juncture? A key contributing factor is that nuclear powerplants have become unacceptable economic risks that discourage private investment. These high economic risks are due primarily to an unpredictable licensing process, construction delays, and high capital costs. This in turn has led to a reduced acceptance of nuclear power by both the utilities and the financial community.

So why not, as some have suggested, just put the current nuclear technology on the shelf for use when it is needed in the future? There are several cogent reasons why this will not suffice from a national perspective.

The first is that current technology must be augmented to meet the intermediate and longer term needs of the Nation. Today's large light-water-cooled nuclear powerplants represent capital investments that are too great for many utilities, their control and safety systems are complex, and their construction is too expensive and lengthy. In the decade of the 1990's, a new generation of advanced light-water-cooled reactors, high-temperature gas-cooled reactors, and liquid-metal-cooled reactors, embodying the best of available high technology, should be available to enable the nuclear industry to provide utilities and other users with less expensive, more quickly constructed sources of power with improved economics and enhanced passive safety features. Beyond the year 2000, the need to extend our uranium resource will require the continued use of advanced converter reactors and the introduction of breeder reactors. Accordingly, we have restructured our development programs to ensure retention of nuclear power as a viable technical and economic option for consideration by the marketplace.

A second reason is that the same institutional impediments that are currently inhibiting private investment in nuclear power will continue into the future unless we actively and cooperatively seek solutions today. Chief among these impediments is the unpredictable and lengthy licensing process. Most nuclear plants now take 12 to 14 years to license. This should be reduced to 6 years or less. The extra licensing and construction time costs the utilities, and eventually the ratepayers, millions of dollars annually. Again this year, the Department plans to submit comprehensive licensing reform legislation aimed at remedying this situation without compromising assurance of public health and safety.

Thirdly, even the best of technologies cannot be effectively utilized without the industrial infrastructure and skilled personnel necessary to make it work. Unless changes are made soon to facilitate the ordering and licensing of commercial nuclear plants, the capability of the United States to produce high-quality reactors will diminish significantly, and the supply of highly skilled nuclear scientists, engineers, educators, and technicians will dwindle. If we fail to take corrective action, the United States may well find itself in a situation analogous to the shortage of scientific and engineering talent of the late 1950's that was emphasized by the launching of the Sputnik satellite.

What is needed is a cooperative effort among the nuclear industry, the utilities, and Government, for the purpose of completing the design of advanced plants using state-of-the-art technology, and obtaining certification of those designs. This, coupled with a stable and predictable licensing and regulatory process, would permit utilities to order "standard or fixed design" plants suitable for multiple site applications, with reasonable economic risk. Then, if the plant is built to specifications, it could be operated without undue delay and, thereby, reduce costs on invested capital.

DOE's role would be that of a catalyst -- not an investor or subsidizer -- to foster a concerted effort to ensure that nuclear power will be a viable option for the market now and in the future. Through cooperative efforts between industry and

Government, removal of the disincentives that have caused nuclear power to become an unacceptable economic risk would enable a new reactor order in the near term. Our mutual goal should be to create an environment in which the private sector will be willing to order an advanced-design nuclear powerplant by about 1990.

The so-called advanced LWRs currently being designed by the U.S. nuclear industry in conjunction with foreign partners for licensing and deployment overseas offer an excellent near-term opportunity to begin solving many of the problems that I have previously described. Much of the requisite technology exists from over 30 years of experience. Several proposed conceptual designs provide greater tolerance to abnormal events and, thus, longer operator response times without unacceptable safety risks. Our efforts will concentrate on stimulating industry to transform these concepts into reality and to seek cooperative solutions to many of the institutional problems that beset the industry.

In parallel, we plan to pursue a continuum of development of advanced nuclear fission technology for the future. History teaches us that the effective application of any basic technology requires both continuing deployment and experience concomitantly with focused research and development to enable improvements in the future. The Department has an historic and valid continuing role in nuclear safety research, as well as the enabling of advanced nuclear technologies.

With this background, I would like to describe the Department's reactor development programs that address these problems. I will only touch upon the highlights and rationale for each of our major programs. We have recently prepared a Civilian Reactor Development Program document that will address in more detail many aspects of the program and our current strategy. We will be providing that document to interested Congressional Committees in the near future. Your comments on that strategy, as well as those from all interested parties, will be welcome.

CIVILIAN REACTOR DEVELOPMENT

The cancellation of the Clinch River Breeder Reactor Project (CRBRP) has afforded the Department a good opportunity to reshape our nuclear reactor research and development programs. In so doing, we have taken the best elements of our existing programs and refocused our efforts more on the near- and intermediate-term needs of the country. There is an increased search for innovative means to meet those needs, and we have a closer coordination among all program elements to assure the most effective use of limited resources.

One feature of our program is increased emphasis on international collaboration. Sharing of operating experience, research results, and facilities with our technical partners will result in safer and more economical nuclear systems. We believe that international collaboration, particularly in costly test facilities and projects, will help restore credibility to the United States as a nuclear trading partner and strengthen our position in international commerce. DOE will assess the possibilities for enhanced collaboration between the United States, Japan, and Western Europe in several reactor development programs. By taking advantage of the strengths of each nation, we can successfully increase our knowledge and reduce our mutual costs for a new generation of advanced reactors.

Effective nonproliferation progress requires that the United States must remain a major, reliable, and credible international supplier of nuclear fuels, services, and equipment. Our influence over other nations in the use and control of nuclear materials will be sharply limited if we cease to maintain our professional and technical leadership in nuclear power.

The Civilian Reactor Development program comprises the areas of Improved Light-Water-Cooled Reactor (LWR) Technology, Advanced Converter Reactor Technology, Advanced Breeder Reactor Technology, Water-Cooled Breeder Reactor Technology, and Civilian Reactor Development Support.

Improved Light-Water-Cooled Reactor Technology

The Improved LWR Technology program is directed at performing generic research and development, building on current designs, that requires a long-term effort using the unique capabilities of Government facilities, and at performing research and development associated with the recovery from the accident at Three Mile Island Unit 2. Efforts will be focused on extending LWR plant lifetimes; enhancing safety; improving licensability, operation, and reliability; and helping to place emergency planning criteria on a rational technical basis.

The Department continues to apply its unique experience and technical resources to the efforts at the Three Mile Island (TMI) site. In return, the experience that we have gained and the technology developed will be of generic benefit to the Government and to the entire nuclear industry. Removal of loose fuel debris is scheduled to begin at TMI in July of this year. Major DOE activities in FY 1986 will include examination of portions of the damaged reactor core at a DOE laboratory and development activities associated with removal of the several tons of fuel known to be in the bottom of the reactor vessel and in the reactor coolant system. This research and development work will contribute directly to the objectives that I have noted above.

In parallel with the technical efforts, the Edison Electric Institute has implemented a plan by which the Nation's utilities will provide General Public Utilities Nuclear Corporation $150 million toward the cost of the cleanup.

Advanced Converter Reactor Technology

The Advanced Converter Reactor Technology program is a key element of our technological efforts. This program includes work on three principal nuclear systems:

- Advanced light-water-cooled reactors (LWRs)
- Liquid-metal-cooled reactors (LMRs)
- High-temperature gas-cooled reactors (HTGRs).

Work on all three of these systems has a common set of objectives:

- To significantly improve system economics
- To develop passive safety features
- To increase tolerance to abnormal events
- To shorten construction times
- To facilitate licensing.

We must marry the very best of U.S. industrial technology with improved reactors in varying size ranges if we are to foster a revitalization of the nuclear option. Each of these reactor types has the potential to do just that. And do it we must, if this country is to have a secure, diverse energy source to meet its needs beyond 1990.

Technology for the next generation of innovative water-cooled reactors will be developed in close cooperation with industry. DOE will evaluate proposed advanced LWR concepts and assess passive safety features with the potential for reducing licensing-related delays in construction. The focus will be to select and complete a conceptual design of a small to medium-sized LWR that utilizes state-of-the-art technology and innovative design features to overcome many of the current problems. Emphasis will be placed on standardized design, increased factory fabrication, reduced cost and licensing time, enhanced safety margins, and improved reliability.

In the area of Liquid-Metal-Cooled Converter Reactor Technology, we have already taken the first steps toward innovative design approaches. We have selected two U.S. reactor design organizations to work under contract to DOE to develop advanced concepts for smaller, modular liquid-metal-cooled reactors of less than 300 MWe output, that offer the advantages of more complete factory fabrication and ease of shipment. Delivery to the plant site of a completed module of standard design could make possible a construction period of only 3 to 5 years from time of order to full commercial operation. This would reduce interest expense, shorten the planning horizon, and permit utilities to enter plant costs into the rate base earlier.

We anticipate that the relatively detailed conceptual designs being developed in this 3-year effort will provide a focal point for this program element and will help focus related research and development work. Designs for liquid-metal-cooled reactors can provide one of several options for advanced and alternative converter reactor designs to be used in the next 10 to 20 years.

High-Temperature Gas-Cooled Reactors (HTGRs) have a variety of unique and attractive features which can provide greater safety and larger investment protection margins. These include the use of an inert helium coolant, a core with high heat capacity and low power density, and the capability to operate at very high temperatures. Additionally, HTGRs have the potential to meet industrial requirements for process heat (as oppposed to electricity generation). During 1985, a reference small HTGR concept will be selected as the basis for conceptual design and development of the requisite HTGR technology base in FY 1986 and beyond.

The international HTGR program will be expanded. The United States will continue to implement the agreement with the Federal Republic of Germany under the US/FRG Umbrella Agreement in

Gas-Cooled Reactor Technology. Planning is also underway between the United States and Japan on a cooperative program in HTGR technology development.

Advanced Breeder Reactor Technology

The Advanced Breeder Reactor Technology program has been significantly restructured since the cancellation of the Clinch River Breeder Reactor Project. We currently have no funding directed to large-scale demonstration projects in any phase of this program. Instead, the program is funded and paced to maintain the breeder as a viable option for deployment in the 21st century.

The current breeder reactor program remains a key link with significant international breeder development and fuel cycle programs, particularly in Japan, France, the Federal Republic of Germany, and the United Kingdom. It is essential that we not underestimate the importance of these ties. These nations are moving toward deployment of breeder reactors on an earlier timetable than we are, because of their differing energy supply circumstances. This presents us with both a unique challenge and a unique opportunity.

The challenge is to further international nonproliferation goals -- goals for which we remain a leading proponent -- even though the United States is no longer leading the deployment of breeder technology. The opportunity is one of being able to capitalize on our past expenditure of resources and our technology leadership in reactor fuels and materials, to obtain overseas operating experience, and thus to reduce future expenditures while maintaining a viable, active breeder option for future deployment.

To be successful in both endeavors requires that we consolidate and extend our technology base through expanded collaborative international agreements. It is essential that we maintain a consistent, albeit reduced, effort in this area to preserve our domestic breeder option for the next century, as well as to restore our credibility in the international arena. The FY 1986 breeder reactor program will actively pursue this objective.

The objective of the Water-Cooled Breeder Reactor program is to develop technology that will improve the efficiency of nuclear fuel resource utilization. Activities in FY 1986 will include the continuation of work associated with the light-water breeder reactor (LWBR) core recently removed from the Shippingport power station, including examination and evaluation of selected fuel elements from that core for "proof of breeding."

In summary, nuclear technology must continue to be an important component of this Nation's balanced and mixed energy system. We must be prepared to offer the marketplace a nuclear option that is safe, technically sound, and publicly accepted, with a stable and predictable licensing and regulatory process. Our nuclear energy programs seek to ensure that there will be a variety of safe and economical reactors and fuel cycle technologies, including advanced light-water-cooled reactors (LWRs), advanced high-temperature gas-cooled reactors (HTGRs), liquid-metal-cooled converter reactors, and advanced breeder reactors, so that private industry can select the best options to meet needs that we cannot entirely predict today.

Closely coupled with our development efforts, however, is the need for Government and all elements of the industry to address the institutional impediments to continued viability of the nuclear option. We need to reform the licensing process through legislative and administrative means, foster the use of standardized designs, permit U.S. suppliers to compete equally in foreign markets, and restore our credibility in the international arena. Only through these initiatives can we ensure attainment of the national energy policy objective of an adequate supply of energy at reasonable cost.

Attainment of these objectives is a prerequisite to realizing the significant benefits of our investment in past, present, and future research and development efforts. The economic well-being and security of the Nation can benefit from our success.

ADVANCED NUCLEAR SYSTEMS

I would like now to describe our Advanced Nuclear Systems program and comment briefly on some related activities of interest to the Committee.

The Advanced Nuclear Systems program supports civilian and military applications of nuclear energy in space exploration through the development of a range of nuclear power systems. As resources permit, we also intend to investigate other advanced technologies under this program. To date, the program has provided the Department of Defense (DOD) and the National Aeronautics and Space Administration (NASA) with the radioisotope thermoelectric generators (RTGs) used as the power source for 33 successful space missions. Since the first uses of these unique power sources in the early 1960's, nuclear energy has been found suitable, and in some cases essential, for a variety of missions involving the exploration and exploitation of space. It has been a very successful program.

Two primary goals have been established for the Advanced Nuclear Systems program. The first goal is to provide the technology base to meet civilian and military requirements for RTGs in present and future space and terrestrial applications. The second goal is to build and develop flight-qualified RTGs to support those programs.

Because of higher budget priorities within the Department in FY 1986, we have elected to focus the Advanced Nuclear Systems program on those activities related to the NASA Galileo and Ulysses spacecraft launches in 1986 and on the continuation of environmental testing and safety studies, which are a cornerstone of the Department's responsibilities. We plan to continue advanced development work as resources permit.

The planned NASA launches of the Galileo and Ulysses spacecraft in May/June 1986 within a 10-day launch window will highlight our major activities for this fiscal year. We will complete the assembly and testing of isotope power units and deliver the units to the NASA Kennedy Space Center. We will also support the launches and make certain that safety documentation and safety testing are complete. Continuation of the environmental and safety testing efforts is vital. To assure that we can meet the power performance requirements of the NASA missions, thermal vacuum testing of the qualification isotope-fueled unit will continue throughout the year at the Mound Plant, and life testing of the electrically heated engineering unit and the 18 couple modules will continue at the General Electric facility. Long-term testing information is crucial to our ability to forecast the performance of the flight units.

OTHER ADVANCED SPECIAL NUCLEAR APPLICATIONS

In the Department's FY 1986 budget submittal, we have a new decision unit called Defense Energy Programs. This new decision unit, which includes the SP-100 space reactor development effort and the North Warning Power Project, has been submitted to Congress as part of the Atomic Energy Defense Appropriation.

In the early stages of the SP-100 program, it was unclear whether the eventual product would be a military or civilian reactor. With the President's new Strategic Defense Intitiative, it has now become obvious that the first application will be for the military. In order to associate the program more closely with other emerging technologies and to ensure close coordination between potential payloads and the power source, the Department of Defense (DOD) has changed management responsibility for the program from the Defense Advanced Research Projects Agency (DARPA) to the new Strategic Defense Office. Consistent with that move, DOE believes that its part of the program also should reflect the military emphasis, and thus we have proposed the program as part of the Department's Atomic Energy Defense activities.

We believe that this move is in the best interest of the program. As part of the Strategic Defense Initiative, we look forward to an early definition of the specific parameters that will satisfy military requirements. Such parameter definition is absolutely necessary if the SP-100 program is to result in a near-term product rather than continuing as a research and development effort. The program needs to be driven by military requirements and a fixed schedule for delivery of the product.

Recognizing this Committee's longstanding interest in and support of space reactor technology, I would like to review these defense-oriented programs with you.

Space Reactor Technology (SP-100)

In 1983 DOE, NASA, and DARPA entered into an agreement to jointly investigate, develop, and fund space nuclear reactor power system technology. The primary emphasis of the SP-100 program has been to assess and confirm the feasibility, advance the technology, and demonstrate the technical readiness of a compact, lightweight, durable, and safe reactor power system in the 100 kWe class (up to about 500 kWe) that can be used in a broad range of military and civilian space missions.

The SP-100 program has been planned as a three-phase program. The first phase focused on evaluating various concepts and establishing technical feasibility. The second phase will focus on a Ground Engineering System (GES) test of one concept selected at the conclusion of the first phase. The third phase will be the flight qualification phase, which will proceed when a specific mission commitment has been made.

The first phase is scheduled to be completed in mid-1985, when a decision will be made among the three competing concepts being evaluated. The concept selected will be ground-tested beginning in FY 1986. The site for the ground test is scheduled to be selected at the same time the concept is selected.

The ground test program is projected to require 5 to 6 years to complete. It is expected that progress will be sufficient to allow a flight commitment in the 1988-89 time period. One of the most likely first uses will be with a space-based radar system. Such a system could require power in the range of 100-200 kWe and could be ready for launch as early as 1992.

North Warning Power Project

There is a need for ground-based military power systems that can operate continuously in harsh environments with little or no attendance and freedom from the need for frequent replenishment of fuel supplies such as diesel oil. Such systems will require high reliability, low maintenance, long lifetimes, and simplified logistics. Nuclear reactor technology appears to offer feasible and superior alternatives to conventional power systems. DOE, the United States Air Force (USAF), and Atomic Energy of Canada, Limited (AECL), are jointly funding a program to investigate and demonstrate the feasibility of using a 15-kWe reactor power source in the North Warning Power Project. The specific application, if the demonstration proves successful, will be to power approximately 39 short-range radar sites associated with an upgrade of the Distant Early Warning (DEW) line across northern Canada. The target is to place a demonstration reactor in ground testing by early FY 1987. This would be followed by one or possibly two prototype reactors placed at designated North Warning sites, to power prototype short-range radar stations. A decision on full-scale deployment will be made as early as 1988.

This concludes my formal statement. I am accompanied by Dr. Lyle Wilcox, our Deputy Assistant Secretary responsible for planning and formulating the reactor and nuclear technology development programs I have described today. Dr. Wilcox and I would be pleased to answer any questions at this time.

Mrs. LLOYD. Thank you very much, Mr. Vaughan. We certainly are looking forward to hearing from you as well as Dr. Wilcox in a question and answer period. I want to thank you for a very broad and a very complete statement today.

I think it is a sad commentary on this committee that we have to use a piece of masking tape to hold the microphone together here.

First of all, I just want to welcome Mr. Morrison. I am so happy to have him. And we are happy to have Mr. Lundine back with us this year, as well as Mr. Stallings, our new Democrat member from Idaho who is going to be a real asset to this committee as well.

Mr. Morrison, would you like to introduce your new members?

Mr. MORRISON. I would be delighted to, Madam Chairman. We have a bright eyed and bushy tailed group on this side of the table, some with particular areas of interest and others just with a general supportive attitude toward the activities of this committee.

Mrs. LLOYD. I think we are going to have a good year.

Mr. MORRISON. I think so, too.

Mr. Fawell is here from Illinois with specific interest in the Argonne programs. Dave Monson from Utah is with us, and Joe Barton was here from Texas and will be in and out during this morning's session.

Mrs. LLOYD. Thank you very much.

Dr. Dugan, would you like to introduce our staff today? One thing about our Committees on Science and Technology and all of our subcommittees is we have had the advantage of a fine, well-prepared and very hard-working and dedicated staff. They are professional people, and I am sure they will be here long after I am gone. I am not counting on leaving any time soon; I don't want to start any other rumors today, either.

Dr. Dugan?

Dr. DUGAN. Thank you, Madam Chairman.

On my immediate right is Nelson Milder who does our liquid metal programs and space technology programs, the breeder as well as advanced nuclear systems. Back here on the right is Ron Williams. Ron does the HTGR Program, Light-Water Reactor Programs, and also most of the Fusion Energy Program. Lou Ventre, our Counsel, is not here; he does Uranium Enrichment and Nuclear Waste Programs. On the Republican side, we have Tim Peckinpaugh who is Mr. Morrison's designee and a former star intern of the subcommittee; and Tom Weimer who is the Republican energy coordinator who works across the board in energy. So, I think we have a very—we will be talking with each other throughout the year and be as cooperative as the chairman dictates.

Thank you.

Mrs. LLOYD. Thank you very much.

When we get to our question and answer series, I thought we would put down some guidelines that we will allow everyone 5 minutes, and then we will go back for second and third rounds of questions as our witnesses have time and for questions we do not have time for we will, without objection, submit them to be replied to by mail and they will be made a part of the record as well.

Please, go ahead.

Mr. VAUGHAN. All right. We are pleased, also, that you have collected on the committee people with interests for several of the major facilities. Mr. Lundine, while you and I have not had the chance to meet, you also have a graduate of the finest university in the South which is also my alma mater.

Mrs. LLOYD. We are also happy to have Mr. Valentine back with us. This is his second term on this committee and he is certainly a very conscientious and hard-working member. We are awfully glad you are here with us, Tim.

We are doing all the introductions this morning.

Mr. VALENTINE. Thank you.

Mrs. LLOYD. Thank you. Please proceed.

Mr. VAUGHAN. What might be of interest if we take just a couple of minutes, Steve Lanes and Howard, why don't you lay up the Vu-Graphs and show what RTG's look like in spacecraft and then a few of the SP-100 concepts and the north warning locations? I think, Madam Chairman, these are the areas that are less familiar to people as nonconventional——

Mrs. LLOYD. If anything, this north warning system is really going to save a lot in manpower that had been at these very isolated locations, that they will take care of themselves. That will really be a tremendous cost savings.

Mr. VAUGHAN. Yes. According to the predictions the Air Force has made that we have looked at, the north warning system does have the potential for an improved life cycle cost using the 15 KWe nuclear source.

Mrs. LLOYD. That is very good.

Mr. LANES. Madam Chairman, this Vu-Graph shows the SP-100 reactor in the cargo bay of the space shuttle. The reactor is the conical item right behind the passenger compartment—I am waiting for the Vu-Graph to be focused a little bit better. The rectangular solid in the middle of the cargo bay is a hypothetical payload, and the cylinder toward the end of the cargo bay is a rocket engine that would be utilized to move the reactor and the payload to a higher orbit for mission purposes once the space shuttle delivers it to a low earth orbit.

Next Vu-Graph, please. This Vu-Graph shows a model of the space shuttle and the reactor. Again, the reactor is right behind the cargo bay.

Next Vu-Graph, please. This Vu-Graph shows the SP-100 reactor in orbit next to the space shuttle with a hypothetical payload on the end. The small cylinder in the upper left-hand corner is the reactor itself. The silver colored semiflared cylinder right behind the reactor is the shield, and the red cone-shaped object is the radiator. The object at the very end, the far end of the boom is a hypothetical antenna, and the square object just behind the radiator is a hypothetical ion thruster for propulsion purposes, electrical ion thruster.

Next Vu-Graph, please. This Vu-Graph shows the SP-100 reactor connected by a boom to a hypothetical radar antenna and a space-based radar is the most likely near-term application of the SP-100.

Next Vu-Graph, please. This picture shows the reactor powering an early possible design of the space station, again, connected by a rigid boom.

Next Vu-Graph, please. That completes the Vu-Graphs we have on the SP-100 reactor. We have two, now showing, applications of our radioisotope thermoelectric generators. This one is the international solar-polar mission with the RTG being the device just under the white circular object in the upper left-hand corner of the Vu-Graph.

Next one, please. This is the Galileo mission showing two RTG's, one on the left and one on the lower central portion connected to the Galileo spacecraft. These are the general purpose heat source RTG's which provide about 200 KWe each.

Madam Chairman, that completes our Vu-Graphs on the SP-100 program and the radioisotope thermoelectric generators.

Mr. VAUGHAN. Let's show a couple of north warning, just to show the locations since Mrs. Lloyd was interested in those. You have about three slides on north warning, Howard.

Mr. LANES. This first Vu-Graph shows the position of the short-range radar stations on the north warning system across northern Canada and Alaska. This is, of course, an upgrade of the distant early warning line or DEW line, which we have had for a number of years.

Next chart, please. This is a cutaway of the reactor. Without going into too much detail, I will just say that it utilizes a combination of technologies that we have had with us for some time. The reactor would use coated particle fuel of the type that has been used for gas-cooled reactors. Heat would be removed from the core by heat pipes and would be converted to electricity by thermoelectric devices, so there are essentially no moving parts on the reactor, the same kind of thermoelectrics that we have used for space missions.

Next one, please. This is a cross section of the core, again showing the central greenish fuel region surrounded by orange control drums, rotating control drums, and the containment vessel and reactor shielding. The first reactor, which we call the demonstration reactor, will be built in fiscal year 1986 and tested then. That will be followed by one or two prototypes placed at actual north warning system radar stations.

Madam Chairman, that completes our Vu-Graphs on the north warning system.

Mrs. LLOYD. Thank you very much, Steve. It is good to have you back. Steve is a former staff member of this committee, as well, so it is good to see you today.

Mr. LANES. Thank you, Madam Chairman.

Mrs. LLOYD. We will abide by the 5-minute rule in the order of appearance on this subcommittee.

Mr. Vaughan and Dr. Wilcox, I would like to ask my first question with reference to the Liquid-Metal-Reactor Program. Of course, the critical issue in this program is the reduction of $40 million in our 1986 budget. Since we have undergone this very significant reduction in the program, I would like you to explain for this committee really the goals as a result of the program cutbacks as well as the reason for these changes in the program.

I think that what we do, regardless of the funding, should be completely goal oriented, that every dollar should conform to a mission and a direction and a timetable.

Are there going to be significant changes as well in the various laboratories from prior years? It is my understanding that ORNL is going to lose about 45 percent of the LMR in the administration's budget request. I want to know what kind of program we are going to have. Are we going to have a program at all with such a drastic cutback in the funding?

If you would address those issues, the goals, the programs, and what is going to happen as a result of this redirection including the laboratories.

Dr. WILCOX. Madam Chairman, I would like to try to answer that question for you.

The redirection of the program, I think, is timely at this point in that in view of what you said in your opening remarks. That is, to get on with doing the business of looking at near-term goals as well as intermediate-term goals, to set them in as secure a way as we can and then move toward those goals in a very positive way. The restructuring of the program is essentially pulling the program back into more of a midterm oriented set of achievements and goals that are easier to determine and to define as opposed to the breeder program as it was structured, which reached out perhaps two and a half decades before the implementation or the definition of the first breeder reactor to go on line commercially.

We feel this is important because there is a great deal that can come out of the liquid metal technologies that can be used prior to the commercialization of a breeder reactor. These liquid metal technologies can be directed, as Mr. Vaughan has indicated, towards reactors of moderate size, of small reactors, reactors that can be put in a test environment to determine their safety, their reliability, their test performance fairly easily, much more easily than would be the case with, say, the very large and sophisticated breeder reactor plants.

So, our goals in the liquid metal program have been moved closer to us, closer to the horizon of saying that within a period of between 5 and 15 years, what kind of new innovative reactors can we bring into the point of knowing the engineering, knowing the research has been done, knowing that the testing has been done, and will be an element in supplying nuclear energy as we would want it to.

The supporting or R&D Program for the liquid metal program we want to try to make similar in many ways to the supporting R&D Programs for the other type of reactors as well, however. We feel that there is a basic or a fundamental R&D basis that can supply and support all different reactor designs. So, when we talk about the advancements in the liquid metal area, we hope that that R&D basis, wherever it is located and whatever its elements would be, also will support the——

Mrs. LLOYD. But we do have different technologies.

Dr. WILCOX. You would have different technologies at the reactor level itself, in certain materials areas, in certain programs for controllability, man-machine interfaces, control room protocols, those are all common among the different types of reactors and reactor systems. What we are doing is establishing that R&D foundation that will supply toward all of these different reactors of the three reactor technologies.

Mrs. LLOYD. Moving on to the work in the laboratories, would you comment on the cutbacks in the laboratories' programs?

Mr. VAUGHAN. What we have had to do, Madam Chairman, is in a very tight budget situation squeeze our belt, if you please, and each of the laboratories and major facilities try to balance the work as best we can. I think the 40 percent number you used——

Mrs. LLOYD. 45 percent.

Mr. VAUGHAN [continuing]. For Oak Ridge, it is my understanding, is just the part in the liquid metal reactor effort, mainly on materials, does not include the cutback in the fuel cycle work. It is my understanding that the net departmental work at Oak Ridge will be up in fiscal year 1986 by 2 or 3 or 4 percent, although the work in the nuclear energy area, like it is at our other major laboratories, is proportionately down as we have to make the best balance we can with the budget dollars we have.

Mrs. LLOYD. I am just skimming the surface, but I was just told my 5 minutes are up.

Mr. Morrison.

Mr. MORRISON. Thank you, Madam Chairman.

Mr. Vaughan, thank you for not only your statement, but also your personal courtesies in visiting with a number of us on the subcommittee yesterday.

I suppose those of us in political life scan the newspapers for our names spelled correctly. I scanned your testimony for something of even greater importance to me and that was a mention of what I consider the crown jewels in our breeder research fleet and that is EBR-II and FFTF. While you mentioned the programs occasionally, you didn't mention those, and I immediately become a little concerned.

I just wanted to ask you a very general question, and that is was a failure to mention these two an implication on your part that these were to be deemphasized as important elements in our long-term energy programs?

Mr. VAUGHAN. That certainly was not my intent. Each of those facilities has a key role to play in the conduct of the programs which I described. I was trying to focus more on the programs we need to do rather than specifically the facilities we need to run to do them.

As many of the new committee members may wish to appreciate the distinction between those two facilities, EBR-II in Idaho is the oldest breeder reactor in the country and is an excellent vehicle for running transient fuel performance testing, whereas the Fast Flux Test Facility is kind of the precursor of the greater than 100 MW liquid-metal-cooled reactor plants in which we run long-term fuels and materials testing and in which we have proved very effective plant operation. It is a potential major trading chip in our international collaboration is our leadership in fuels and materials technology where I think we are ahead of our foreign competitors.

We do plan, in the 1986 budget, to continue the operation of both of those facilities. We may have to slow the pace of some experiments somewhat, but we do plan to continue both of those facilities.

Mr. MORRISON. Music to my ears. Thank you.

You partially answered by second question, that is, you are supporting a long-term operating mission, and I am particularly now zeroing in on the FFTF? Your plans do include long-term operation of that facility?

Mr. VAUGHAN. That is correct.

Dr. WILCOX. Can I, perhaps, elaborate a little on that? Congressman, that is an extremely valuable facility, as Mr. Vaughan has indicated, because it is a state-of-the-art facility in looking at fuels, fuel materials. In our international program, working with Japan, for example, we see this as one of the things that is of key interest to Japan where some of their materials and material longevity can be tested in FFTF. So, it provides a trading mechanism and a trading medium. It can be not only our pride and joy but an international showpiece as well.

In addition, there are some advanced procedures and technologies that could be used at that facility on an experimental basis in bringing computerization into control room strategies. It has that option. We can continue to build from that point of view in the FFTF.

Mr. MORRISON. Dr. Wilcox, could you share with the subcommittee the status of that international cooperation? Where are we? Are we negotiating? Are we, in fact, receiving funding from other sources?

Dr. WILCOX. We are negotiating in terms of perhaps testing fuels or fuel configurations and metals in FFTF. We are talking with working groups from Japan that come to look at FFTF, the type of operation there, and take that back to their country in terms of their plans for the MONJU reactor. We want to increase that kind of articulation of interest, engineering as well as design interest between the two countries.

Mr. MORRISON. At this same facility, there is some consideration of a power addition program. Assuming that no direct Federal funding is involved, would the administration support future operation of FFTF to allow for the cost-effective addition of steam generators to FFTF for power addition purposes?

Mr. VAUGHAN. If you put the caveat of no Federal funding, I think we would be quite willing to continue to explore with the people in that region a practical way to accomplish that with a reasonable payback. My understanding is that the studies that have been run indicate, depending on how much of the power you could sell in a cogeneration mode, you are talking somewhere between a 5- and 15-year payback which gives you, given 5 years to build the facility add-on for a powerpack, there somewhere between a 10- and 20-year lifetime commitment. It is one we are going to have to take the data and carefully explore.

We have not had budgeted funds available, as you know, to put Federal funding into that.

Mr. MORRISON. Just one other question; I suppose I have a minute or so left, hopefully. Right next to that facility is the Fuels and Materials Evaluation Facility, FMEF, and we have had some change of mission and of heart, very frankly, during the 4 years that I have been involved. Can you share with the subcommittee what sort of long-term plan you might have in mind to use this FMEF hot cell facility?

Mr. VAUGHAN. As some of you know and others may not, included in this FMEF building is the so-called secure automated fabrication facility for fuel, making plutonium fuel remotely which is a vital part of the front end of the fuel process. The center process cell does have the capability to put in a pilot type reprocessing facility which has had the acronym of BRET, Breeder Reprocessing Engineering Test. We have the fuel cycle technology, the reprocessing technology somewhat in hand, are continuing the technology development at Oak Ridge. We have had to put BRET on the shelf in tight budget times. That is an area where we might be able to get some cooperation with people like the Japanese in the future. The space is being reserved for that project.

The Department is looking at some alternative uses of that building for laser isotope separation for a defense related project, but I have personally walked through the building looking at the space as it would be used for that and concluded it would not interfere with the missions for either the SAF line or for the BRET demonstration.

Mr. **Morrison**. Thank you, and thank you for the time, Madam Chairman.

Mrs. **Lloyd**. Mr. Fawell?

Mr. **Fawell**. May I say that name is FAY-well, and it is very common for people to mispronounce it.

Mrs. **Lloyd**. Well, I started to ask you if it was Fallwell; I am glad you corrected all of us. Thank you very much.

Mr. **Fawell**. Yes, and I am confused with Mr. Falwell from time to time, too.

Mrs. **Lloyd**. I always want to be careful to make that distinction in this subcommittee, sir.

Mr. **Fawell**. Thank you.

Mr. Vaughan, as you know, I have talked to you briefly in reference to Argonne National Laboratory which apparently is earmarked for some very significant cuts, as I understand it, from $30 million in fiscal year 1985 to $9 million in 1986 in reference to what, and I am not as familiar with all the terms here, Advanced Reactor Research and Development Program. More specifically, this would, I am told, just about do in the Integral Fast Reactor concept which is now under development at Argonne National Laboratory which would also, and this is only parochially speaking, mean approximately 1,000 to 1,200 of the personnel out of 3,500. This is on top of the cuts that have occurred in the last 2 years which I think are in the area of 400 to 700. In short, very parochially, it is what is deemed at Argonne to be a staggering blow to the institution, and from everything I can see, and I am a newcomer to the scientific terms here, to the Integral Fast Reactor as a very innovative and new concept, newest of all the concepts I think we can talk about here, which would be simply obliterated.

So, my question is, why these severe cuts? I understand there are $13 million more in cuts of other programs aimed at Argonne, but specifically, why is the IFR program at Argonne being eliminated in light, especially, of your statements that we should have the very best of options and most innovative options to be able to set forth for the future?

Mr. **Vaughan**. Let me comment just a second on the numbers that you used, and then I will ask Dr. Wilcox to comment on the Integral Fast Reactor testing effort separately.

I think the numbers that you used were broad across the board for Argonne as opposed to just those associated with the nuclear energy programs we are talking about here today. Any numbers like that that you hear at this stage of the game are kind of preliminary allocations. There have been no final decisions that that is exactly how many people Argonne or any other lab will get or that is exactly the number of people that will lose jobs. That has to be looked at in a total departmental perspective and is being done.

It is true, that consistent with the belt tightening I described a while ago, in the nuclear energy programs which are the ones we are talking about here today, there is about a 19-percent funding reduction over last year's efforts, and that is just part of the overall balancing of budgets.

However, potentially, the number of people associated with that portion of the work is 100 to 300. Hopefully, there may be in other disciplines where those people can contribute either in other civilian applications, defense related applications, and the total picture for Argonne is one we have to look at across the board within the Department.

Dr. Wilcox, do you want to respond briefly on IFR effort?

Dr. WILCOX. It is very true that this is a new initiative, a new direction, a metal fuels direction as contrasted with an oxide fuel direction. In terms of the activities for 1986, there will be some testing done of this concept. This testing will be done by using the FFTF and the EBR-II test reactors to look at those fuels, to look at the fuel performance, to look at some of the claims that are made for their performance. In any program of this type where you are embarking on a new major initiative, it is important to get the initial conditions pretty well set to make sure that some of these initial tests verify that this is a direction that should be taken.

I don't think that we are implying that we are shutting this kind of an initiative off. We are looking at it during 1986. We are not talking about the same relative time schedules as Argonne National Lab would be looking at, but we are doing some evaluation in 1986.

Mrs. LLOYD. Thank you very much.

Mr. Stallings.

Mr. STALLINGS. I am also concerned about the Integral Fast Reactor. With the Argonne facility, both in Illinois and in Idaho geared up to take that kind of responsibility, I would certainly encourage the investment in that particular form of reactor. It seems to me it is a system that answers a lot of questions that our other reactors have not.

Let me turn to a little different question. I understand that the North Warning Reactor Development Program is being managed by the Idaho project office. Could you describe the present program in this area for me, what would be accomplished in fiscal year 1985 and what are your plans for fiscal year 1986?

Mr. VAUGHAN. I think I described those basically in my opening statement. In 1985, we plan to basically finish the conceptual design of this 15 KWe reactor. In 1986, we hope to be well along toward putting together a prototype reactor for demonstration testing.[1]

Mr. STALLINGS. Are you supporting or is the administration supporting the funding for this activity?

Mr. VAUGHAN. Yes. And there is cooperative money also coming from the Air Force as well as for Atomic Energy Commission Ltd. of Canada which is a quasi-government organization, I think, is probably the best way to describe it.

In addition to our defense interests, the Canadians have some civilian interest in this type of small reactor which they see as a stable power source for some of their distant outposts in the cold north regions as kind of an independent small power supply.

Mrs. LLOYD. Thank you very much.

Mr. Lundine? Oh, he is gone, excuse me. Mr. Valentine?

Mr. VALENTINE. Thank you, Madam Chairman.

I just have one or two questions that I hope don't seem impertinent but I notice that approximately 19 percent of the funding for this liquid-metal reactor project goes to industrial contractors, that is, into the so-called private sector. Most of that money, as I understand it, would be spent by General Electric and/or Rockwell. A lot of what they are asked to do is in the nature of experimentation, innovative design efforts and that sort of thing.

My question is, in this country or with reliable firms overseas, is there any true competition for these projects? And what is the procedure, Mr. Vaughan, to see to it that the taxpayers really get what they pay for or does it come down to a situation where we just hope and pray that we do and say, "We have so much money and you have the know-how, and here it is. You spend it." What do you do about that?

Now, I take it, in this area, if you talk about innovative design, there is no way to prepare specifications and to put this out to the lowest competent bidder would be difficult because you are talking about experimentation, you are talking about imagination, you are talking about innovation. What procedures do you folks follow to try to see to it that we get our money's worth?

Mr. VAUGHAN. In fact, Mr. Valentine, with those innovative concept efforts, we did just that. We had a request for a proposal which we shared among a number of people, and used a technical evaluation board to look and select the concepts which seemed to have the most promise as new concepts. So, we did go through a combination of technical and fiscal selection. The amount of money available for those was balanced about equally between the two contractors. The contractors are contributing their own money to the efforts.

I think it is also important to understand that in those efforts there is a good deal of cross pollination with our national laboratories and our experimental facilities with those individual reactor designers and manufacturers. For example, those contractors will identify R&D needs that may be carried out directly in consultation with one of our national labs, for example, Argonne or others, or they may identify needs that will help drive the Department's R&D program funding.

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[1] NOTE.—DOE effort on the North Warning Project is principally at Los Alamos National Laboratory.

Mr. VALENTINE. Are there corporations in this country who are in direct competition with either one of these two for these funds?

Mr. VAUGHAN. There were several people who offered proposals for that particular set of conceptual design efforts, and these two were selected.

Mr. VALENTINE. Thank you, sir.

Mr. VAUGHAN. The other companies, for example, included Westinghouse and Stone and Webster, among others. These things are not ones where we just can afford to sit and write checks to everybody who wants one. We have to do it as fair and equitably as we can, looking at the most promising concepts. Indeed, you do need to make both technical and fiscal judgments.

Mr. VALENTINE. Thank you, sir, and thank you, Madam Chairman.

Mrs. LLOYD. I think we just went into session and then recessed, all at one time.

Please proceed, Mr. Monson.

Mr. MONSON. Thank you, Madam Chairman.

Being a new kid on the block and having a lot to learn, I hope that you will bear with me, and I also hope that the other members of the committee who are more familiar with these things won't mind my asking some questions that will help me to become more familiar with them.

I do have a specific question before I get into a more general question. Your testimony on the SP-100 indicated that you are in the process for selecting a site for ground testing. I am interested in knowing what sites are being considered and what the characteristics of the site selection process are?

Mr. VAUGHAN. We will have a formal site selection process in which we will evaluate the capability of the facilities and the people and the economics of performing the test as well as the capability of ensuring the public health and safety. We will have agreement among NASA, DOD, and DOE on the site selection criteria. It is now being reviewed in a formal process. We will charter one of our field offices to do a very careful evaluation, and we will then end up making the selection by a senior DOE official, probably me, reviewing all the results against a predefined set of criteria so that everybody knows what it is in the beginning.

The six sites that are being considered are sites at the Idaho National Engineering Laboratory; the Hanford Reservation; ETEC, Energy Technology Engineering Center which is in Santa Susana outside Los Angeles; the Nevada test site; the Sandia Laboratory site; and a site at the Oak Ridge National Laboratory. Those are the six sites that are currently being considered.

Mr. MONSON. Now, in looking over the summary of the budget proposals and with what little I have read about the direction that the budget has taken in reactor development programs over the last decade, as I understand, it has gone from about $1 billion down to now where the request for fiscal year 1986 will be $350 million. Help me to understand what has transpired over that 10 years that has taken this direction, has caused this direction to be taken. Do we not need to put as much Government funding into this type of development any more, or are there just too many higher priorities or what is the cause of this?

Mr. VAUGHAN. I think you have probably a combination of circumstances. In the year that you cite the $1 billion level, that undoubtedly includes the years when the Clinch River Breeder Reactor Demonstration Project was moving apace as a major demonstration plant. The Congress decided to cancel that project despite the fact that the administration recommended that it proceed. It was that thrust that has caused us to reexamine and refocus the program on the nearer-term objectives. Notwithstanding that, the level of funds are decreasing. If you subtract out the Clinch River Breeder Reactor Project, for example, between 1984 and 1986, you see a drop from about $471 million to $350 million excluded the advanced nuclear systems and the special space reactor projects that we discussed.

That is the net result of tight budget times and trying within the Department to balance as best we can our overall priorities. It does not mean that the programs that are not being funded are bad programs. It simply means that that is the net result of balancing priorities.

Mr. MONSON. Are these decisions coming from OMB or are there lids being put on what you can request or how are you arriving at this?

Mr. VAUGHAN. The Department ends up with an overall set of budget priorities and targets. OMB is obviously a participant in the process. We go through an internal review budget process in the Department and balance the priorities. Nuclear energy programs typically get their fair share within that balance.

As you well know, the net result of the President's efforts this year were to indicate that overall the Department needed to live with a civilian budget level of about 10 percent, approximately, a little more, less than fiscal year 1985 spending levels. We did the best we could to balance the dollars within those constraints.

It is not an easy process, and it is one which is impossible to satisfy all the interests and to complete a number of good programs that we simply can't afford, given the budget limitations.

Mr. MONSON. Thank you.

Mrs. LLOYD. Thank you, Mr. Monson.

Mr. Young, you weren't here when we welcomed all the members, and you are a very faithful member of this committee. We are very happy that you are here this year as well.

Mr. YOUNG. Thank you very much, Madam Chairman.

I just have one question, and I really haven't had a chance, Mr. Vaughan, to go over your full statement, but although the committee generally agrees with the new initiative at the Department in the breeder program, some in the industry don't agree with the small reactor idea. Have you given these people a chance to express their views, that is, those who believe that the large reactor design is still the way to go? Are they wrong in this concept or what would your statement be relative to that question?

Mr. VAUGHAN. I am going to let Dr. Wilcox respond to that one, because he has had a number of these conversations with varying people in industry. I think you were not here at the beginning when I did comment that we have tried to build our bridges, to listen to the industry, to EPRI, to other organizations in order to do the best we can to work in concert with other efforts that are going on.

Dr. Wilcox. Congressman Young, I think it is true we have tried to listen carefully to the different views coming from different directions, and it is true that there will be some customers of nuclear reactors that would say the larger ones are really what is needed. There are also others that will say no, we don't know what our incremental growth is going to look like and that if we can take smaller bites of this package, perhaps we would be better off, and hence, the smaller reactor that can be incremented up from a modular base.

I think, though, we have defined a program that allows us to look at all of these alternatives without preempting any one of them. Internationally, we know that there are still large plants being designed and built. We know that some of our American vendors are working with foreign interests in the design, building, and manufacturing of large light-water reactors, for example. We are certainly going to remain cognizant of any advantage that we can take of those designs, advanced designs of current larger reactors. So, we have that running concurrently with this fresh look at the smaller concept with the advantages that we have described to you in terms of passive safety and constructability, manufacturability, and, on top of all of that, bringing the highest of technologies that we can in to bear, whether it is a large system or a smaller one.

Mr. Young. Fine, thank you. I appreciate it. I am probably going to follow up with some questions to you and Mr. Vaughan relative to that question when I get a chance to go over your testimony.

Thank you very much.

Mr. Stallings [acting chairman]. Mr. Morrison, do you have anything additional?

Mr. Morrison. Yes, thank you.

I guess I have a basic concern about policy, and I know there are a number of policy documents which I have not yet read, and you have a new one out which you mentioned in your statement, Mr. Vaughan. I have a feeling that this subcommittee feels some high level of responsibility, and would like to be part of assisting the Department in advancing a program, but we can do our best job of selling to the Congress if all the elements, the direction you are taking as far as funding is concerned fits in with a national policy.

You mentioned the desire to have in place new standardized manufactured reactors somewhere which speed up the time for actually building plants planned by 1990. Does that fit in with the projected need for electrical energy as the Department sees it, as we have this phenomenon of parallel growth with GNP?

Mr. Vaughan. That is a question that we are trying to seriously examine within the Department and with other people who do work on electricity forecasts. It does seem pretty clear that electrical growth will increase at least equal to if not greater than the GNP. I think statistics show that.

The electric utility industry has not been the best in the world in forecasting load growth demands, nor has the Government or other agencies, and we could debate whether we are going to go on a 2 or a 5 percent curve, but I think under whatever scenario, it is pretty clear we will need to order new generating capacity, to start building it in the 1990's as opposed to having it built by the 1990's.

There has been a real hiatus, as we all know, in building both coal-fired plants as well as nuclear plants. I personally feel that if we are not careful, we could end up with the electrical generating crisis of the 1990's or the 2000's just like a number of years ago the Russians launched Sputnik and all of a sudden we woke up and said, "We are behind in space technology." The numbers are hard to predict, but we are trying to work very carefully to achieve a kind of as much national consensus on that effort as we can.

We will look forward to working with this committee in helping to do that.

Mr. MORRISON. Perhaps we could have Mr. Stockman in forecasting GNP, and then we will just have a multiplier we use for electricity and spin that back into the budget numbers we are looking at today. I think we would end up with a different product.

Do you foresee the possibility that we may end up with industry reacting as opposed to utilities, that is, part of your design concept would mean that the manufacturers of nuclear plants would come in and say to a utility, "We will build a facility and even operate it; we will just sell you the electricity at such and such a rate on through the years head of us."

Mr. VAUGHAN. That is certainly a conceivable outcome. Certainly, a piece of it is that industry needs to design, have the capability to build, and to obtain certification of the plant design. The step you describe is a step beyond. That is possible. I am not sure I want to speculate on which way it will go.

Lyle, do you want to speculate?

Dr. WILCOX. Not specifically, but I think in terms of the general issue that you raised is the need for energy. It is electrical energy following the gross national product. I certainly feel that we are going to have some energy problems developing unless we start planning now to solve those issues. One of the things that quite often doesn't come into that equation is although we are talking about new ideas at this point in time, new concepts, potential new reactors, there is a very long timeframe, time horizon between the point at which we say, here it is, the perfect reactor, now build me one. That still is a long period of time. I think we have to be looking out much more aggressively in front of ourselves in order to meet that need.

Mr. MORRISON. I appreciate those comments. Somehow we have to help the American public understand that even though our energy uses of other sources of energy have gone down that electricity still runs ahead of the percentage of growth of the gross national product and the two seem to be inextricably tied together. We need to make that point.

Mr. Chairman, thank you for the extra time.

Mr. STALLINGS. Mr. Fawell?

Mr. FAWELL. Mr. Vaughan, I would like to return to Argonne as you might have guessed. I hope, certainly, that your figures as to loss of personnel, you mentioned 100 to 300, is correct, simply because all the best figures that at least have been given by DOE to Argonne seem to indicate the figures that I referred to, a $21 million decrease in advanced reactor research and development. I would like to talk more specifically with you after this. I won't take the time at this preliminary stage. I know that there are an awful lot of figures going back and forth.

However, I am concerned by the conclusion, and I have I suppose made myself a nuisance at Argonne by asking these questions, but they take the view that, with the funding as they see it, the Integral Fast Reactor R&D can't be done. Dr. Wilcox, you have indicated there is going to be testing, but does not R&D come before the testing? And without R&D, what will Argonne West, for instance, have to test insofar as that program is concerned? If we don't have it, if that is so, how do you keep the scientific personnel? Consistency, is it not, is a major element? Could you comment on those factors?

First of all, are we funding R&D for the Integral Fast Reactor at Argonne or are we not?

Mr. VAUGHAN. First of all, when we talk about testing, testing is an integral part of research and development in our framework. So, testing is a part of research and development.

Mr. FAWELL. But are we doing the R&D? Are we researching, and just for my purposes of definition, putting testing over here—for instance, I understand that in Idaho Falls they do the testing. At Argonne in Illinois, they do the research. I understand the research is being eliminated and the research is the foundation for the testing, is it not? If you don't have the research, how can you test?

Mr. VAUGHAN. I think what you have here is an evolving situation in a continuum of development. It is partly up to Argonne to decide how they distribute the work between East and West, subject to our review. There are several critical technology proof test pieces for what Argonne calls the Integral Fast Reactor concept. Some of those have to do with the question of whether the fuel which is a new type of metal fuel different from the type that has been used in EBR-II and different from the oxide fuels that form the basis for other metal reactors, will——

Mr. FAWELL. Excuse me, can I just interrupt? I am sorry to do so. I only have the 5 minutes and they seem to go by awfully fast. Will there be sufficient funding, in your opinion, in this next fiscal year at Argonne to be able to do any research work, or are we talking only about testing? If you could make that a concise answer it would be helpful.

Mr. VAUGHAN. Well, but there is not a precise answer to that question because Argonne will have to come back to us with the total funds, and propose their particular work program and how they want to carry it out. There will be less funds for that effort in 1986 than Argonne would like to have.

Mr. FAWELL. How much less?

Mr. VAUGHAN. We have not picked a specific number, but I would guess it would be on the order of $10 million less than they would like to have.

Mr. FAWELL. What would it take to fund the research on the Integral Fast Reactor for 1 year?

Mr. VAUGHAN. Probably $10 to $15 million.

Mr. FAWELL. So, it would pretty much puncture and eliminate the program, then, wouldn't it, if you took away $10 million?

Mr. VAUGHAN. The fiscal year 1986 level is—kind of puts it on a flat low level. There are some important proof tests that will continue on the fuel in the EBR-II reactor as well as some tests on the reprocessing concept.

Mr. FAWELL. Excuse me, are you familiar with the peer review study that DOE in Chicago asked for?

Mr. VAUGHAN. Yes, I am.

Mr. FAWELL. And their recommendation that this is high priority for research and development?

Mr. VAUGHAN. Well, I understand the results of the peer review group. I have personally looked at them. We are making a judgment among a number of high priority programs. The success or failure of the liquid-metal reactor effort probably will not sink or swim on whether you use metal fuel or oxide fuel in the reactor core. The form of the nuclear fuel is not our major problem in restoring the nuclear option in this country. The problems are beyond that.

That doesn't mean that the program does not have potential. It will be interesting to see with the efforts funded in 1985 on the reprocessing technology and the continuing fuel tests that are being conducted in EBR-II as to whether that concept has as much promise as Argonne advertises it. The peer review did clearly indicate that the areas that are now being tested are critical. If they come out far better than expected, it gives us an opportunity to reexamine where we are going.

Mr. FAWELL. Madam Chairman, is it proper to submit for the record a copy of the peer review study?

Mrs. LLOYD. If you want to complete another question, we have 20 more minutes before we have to recess. Then, we will submit questions for the record also, but go ahead with your thought.

Mr. FAWELL. Well, I was wondering, too, if I could simply—I have a copy of the peer review study in a summary and I would like to submit it as a part of the record with the consent of the committee.

Mrs. LLOYD. Without objection, it will be made a part of the record.

[Material to be supplied follows:]

2-13-85

Summary of the Initial Report of the University of Chicago Special Committee for the Integral Fast Reactor (IFR)

Background

Following the demise of the Clinch River Breeder Reactor, a new breeder reactor concept offering the potential of lower cost, safer operation, and resistance to theft was advanced by Argonne National Laboratory (ANL). The Integral Fast Reactor (IFR) is based on metal fuel, a pool configuration, and reprocessing facilities integral with the reactor plant. A Special Committee of respected experts was convened by the University of Chicago (operator of ANL) in July 1984 to conduct an independent technical peer review of the IFR, in keeping with the University's practice of creating such committees to review new initiatives at ANL. This committee was also intended to respond to a request from DOE-Chicago to the University to convene a committee of independent experts to review the IFR and answer DOE's questions regarding the feasibility of the concept and adequacy of the proposed ANL program. The highly distinguished group was formed and its charge developed with the concurrence of DOE-Chicago and DOE-Washington. The members are:

Dr. Max W. Carbon, Committee Chairman
Chairman, Department of Nuclear Engineering
University of Wisconsin

Mr. Wallace B. Behnke
Vice Chairman, Commonwealth Edison Co.

Dr. Manson Benedict
Emeritus Prof., former Department Head
Department of Nuclear Engineering, MIT

Dr. Hans Bethe
Nobel Laureate in Physics
Anderson Prof. of Physics, Cornell University

Mr. Spencer H. Bush
Retired, former Sr. Staff Consultant
(Metallurgy of reactor metals, nuclear reactor safety)
Pacific Northwest Laboratory

Mr. Walter J. McCarthy, Jr.
Chairman of the Board, Detroit Edison Co.

Dr. David Okrent
Chairman, Mechanical, Aerospace and Nuclear Department
UCLA

Mr. Lombard Squires
Retired, former Manager Atomic Energy Division
DuPont Co.

Dr. Richard Wilson
Mallinckrodt Prof. and Chairman, Department of Physics
Harvard University

The committee has completed its initial review and issued a report. It's findings are summarized below. The complete report is available upon request from the University of Chicago, Office of the Vice Pres. for Research and ANL.

Findings of the Committee

1. There is a national need for a proven breeder reactor since the breeder represents the one single technology in existence today which has been demonstrated to be practical and have the capability to provide an inexhaustible source of power.

2. The IFR appears to offer a new, exciting approach for the U.S. to recapture leadership in breeder technology.

3. The capital costs to develop and demonstrate the IFR metal fuel element and the associated fuel cycle appear to be modest and could be accomplished rapidly.

4. The IFR offers a breeder concept in which the potential for theft or diversion of fissionable materials is significantly minimized and offers significant non-proliferation advantages over fuel cycles based on the Purex process.

5. The scientific evidence in support of the concept is judged to be more than adequate to justify proceeding rapidly with research and development and demonstration of feasibility as presently envisioned for the FY85 and 86 period.

6. The committee is favorably impressed by the potential of pyrochemical reprocessing. It is inexpensive, has many operational advantages, and as stated above minimizes the possibility of theft.

7. Characteristics of the metal fuel tend to give the metal-fueled reactor the ability to tolerate a variety of transients as readily as, and possibly more readily than, an oxide-fueled reactor.

The committee concludes that:

- The IFR concept offers many important benefits, and
- The scientific evidence on which the present concept is based, although limited, is sound.

It is strongly recommended that ANL move forward at a rapid pace to explore further the feasibility of this concept.

Mr. Fawell. Do I have additional time or——

Mrs. Lloyd. Did you finish your thought?

Mr. Fawell. I had just one other question.

Mrs. Lloyd. OK, go ahead.

Mr. Fawell. Could you tell me where the dollars in fiscal year 1985, or are the dollars in fiscal year 1985, and what they are in 1986 in reference to R&D in regard to the IFR?

Mr. Vaughan. Do you know the specifics?

Dr. Wilcox. No.

Mr. Vaughan. This is Mr. Del Bunch of our staff who will respond to the particular numbers.

Mr. Bunch. The IFR numbers in 1985 in terms of specific funding is $10 million. In addition to that, the technical staff at Argonne also is involved in a variety of tests which, with minor modification, can be adapted to gain additional information relevant to the IFR.

In 1986, we have no specific funds set aside for IFR tests. As Dr. Wilcox pointed out, the irradiation programs in place, the fuel technology programs in place, will be evaluated, but not continued, pending reviews of the work that is being done right now.

Mr. Fawell. You mean there is no money for R&D in the 1986 budget? You said testing.

Mr. Bunch. In 1984, we undertook a feasibility test program. That program was for a 2-year period. That included core design, fuels and materials testing, reprocessing technology investigations. The key aspect of that was whether or not the fuels would perform in a way different than metal fuels performed in the 1960's. Those tests, as your peer review report indicates, are essential to whether or not this concept is feasible. Those tests will be put in the reactors for irradiation 1985. The remaining technology programs recommended by Argonne will be deferred.

Mr. Fawell. That is the main point. So, there is no R&D in fiscal year 1986. There is testing.

Mr. Vaughan. Mr. Fawell, I don't want to get into a debate with you, but——

Mr. Fawell. No, I don't mean it that way. I don't want that. I am just trying to get the figures.

Mr. Vaughan. But continuing testing of the fuels in EBR-II which will continue in 1986 is an integral part of the R&D effort. So, I don't want us to end up responding for the record making an implication that testing is not a vital and necessary part of R&D.

Mr. Fawell. I certainly understand that. My point is, however, you aren't conducting R&D. There ain't nothing to test eventually. And for a full year lapse, where will the science personnel go? They won't just stay there with a $10 million lapse. Consistency is, is it not, certainly an integral part of research and development? You can't expect scientists to wait a year and relocate and come back.

Mr. Vaughan. We, indeed, all have to grapple together with the problem of what is the best way to use the science and engineering talent we have in the national labs, and there is not a simple answer to that. But, in fact, at the 1986 funding levels, it will be, as now forecast, it will be difficult for Argonne to keep as many people as they now have applied to that project. Hopefully, there are other useful things that the same basic talents and the same basic skills can work on.

Mr. **Fawell**. Thank you.

Mrs. **Lloyd**. Thank you.

Mr. Monson, for the record, since you are a new member, I would like to let you be informed a little further on Clinch River. It did, unfortunately, the program did end, but after this subcommittee kept it alive for about 4 years under the Carter administration. Unfortunately, it saw its demise on the Senate side this past year. So, I want us to really get the record straight on that. I would like the record to show what really happened on this very unfortunate program.

I would like to get back to the HTGR program, Mr. Vaughan. I think from the budget it is pretty clear that the DOE doesn't intend to pursue the modular HTGR program in a goal oriented program aimed at a test project—I think we discussed this briefly yesterday. They are really not working toward design, toward fabrication, and also for validation of testing, because on page 186 of the budget, there is stated that the "selection and further development of the reference concept will be closely coordinated with appropriate user groups."

Now, the primary participants in the program, Combustion Engineering, GA, General Electric, and Gas Cooled Reactor Associates all agree that the program should move ahead aggressively. However, these participants have not yet been organized in a constructive manner with a clearly defined, long-term program responsibility. Why is it that the upper management has not supported the HTGR's as it should be?

Mr. **Vaughan**. I think, Mrs. Lloyd, that probably what we have is a question of pace rather than objectives in the sense that I get the feeling that the consensus of all those organizations, and I know you are going to hear from them tomorrow, is not quite as unanimous as some would have us believe. There are still advocates for the modular side-by-side concept as well as the modular in-line concept. As I mentioned in my opening statement, I do believe that the Department's design effort in concert with these activities will focus on the modular side-by-side effort for the remainder of the year.

Mrs. **Lloyd**. I think that is what has been agreed upon. Is that not correct, the side-by-side concept?

Mr. **Vaughan**. My understanding is that most of the participants agree on that as the primary design. As soon as we can come into complete, clear focus on that, and if we can accelerate the pace from the selection at the end of this year, we will certainly do that.

The Department's policy, as you know at this point, is not to fund demonstration reactors but rather to work together with industry for that to come from the marketplace. If we can come up with a reasonably good conceptual and detailed design, it may be quite possible that, if we have enough funds there is a way for the Government to participate in some sort of what I will call a safety demonstration test, for lack of a better term.

As you know, and it might be of interest to some of the newer members, the HTGR and others of these reactors rely on some of the inherent properties in the fuel and their temperature resistance of the materials for safety. One of the best ways to prove that reliability, in the absence of external safety systems, is to conduct some sort of a modular safety demonstration test. That is a proposal that the Department would have to consider, I would say, within the next year or two.

Mrs. LLOYD. I am again referring to page 168 in the budget that states "the selection and further development of the reference concept will be closely coordinated with the appropriate user groups." I really think that this subcommittee is going to demand more action and more thrust in this program.

It seems to me that DOE doesn't want to develop a right reactor because this is something the administration thinks the private sector can do, but I think this position really fails to recognize the fact that the Government controls nuclear energy. Anyone who invests in this venture must realize that they are controlled by others in accepting this great risk. So, I think the case is there for further investment beyond safety R&D. I hope that we can——

Mr. VAUGHAN. As you know, we are working closely with the Gas-Cooled Reactor Associates organization as kind of the coordinator of the industry effort. With the total DOE program management review effort, I would expect to see a proposal evolve from that effort for some form of test within the next year or two. We will have to see what kind of money we have available.

Mrs. LLOYD. What I was referring to, I think that we must develop a concept that NRC can license, that we can take to the NRC. I think we need that type of involvement. We laid out in the last Congress the directions that we wanted to go after the demise of Clinch River, and I think that this subcommittee and this full committee as well as the Department of Energy have a charge to move ahead in new directions, to not just talk about these programs or look at safety features.

This is the year, even though we do have budgetary constraints, that we need to move in a positive and a specific fashion. I must warn you that if we don't, we are going to see the same chopping away at our budget as we saw in the last Congress. I certainly know that that is not the goal of the Department of Energy or this committee. I do not say that from an adversarial position. I just really wanted to enforce what our responsibilities are.

Mr. VAUGHAN. And you may be aware that we have been trying to work as closely as possible with NRC to encourage the use of an advanced concepts licensing process. In fact, they are moving in a direction to set up a separate review process for these advanced concepts. Part of our effort is to use the HTGR and other designs to help facilitate that interaction, to hopefully do that on their technical merits. Anything that this committee could do to encourage NRC to proceed apace with that would be appreciated.

Mrs. LLOYD. We are looking forward to that, also.

We had a good hearing this morning. I am so enthusiastic, not only about all the members who are here, but the audience participation as well. We didn't get to finish our questioning, obviously, and without objection, we will be submitting questions in writing that I do want to be a part of this very important hearing which really is the backbone of all that we are going to do this year.

Mr. Morrison, do you have further comments?

Mr. MORRISON. No, Madam Chairman, thank you. We are pleased with the hearing, and thank you for your consideration on this side of the aisle in allowing questions and written questions to be submitted.

Mr. VAUGHAN. Madam Chairman, may I say how pleased we are for the courtesies you have extended to us, for the continuing support of this subcommittee. I think our objectives are mutual, and we need to work together to do that. Again, let me reiterate, particulary for the benefit of a number of the new members on the committee as well as any of the old ones, too, we would be happy to provide any additional briefings, visits to facilities, or anything of that sort we can do to help enable an understanding of the programs.

Mrs. LLOYD. I appreciate your attitude and your ability and the wisdom of your experience today.

The subcommittee is adjourned until 1:30 p.m. tomorrow. We will meet in this same room. We will hear from our non-Government witnesses on these programs at that time.

Again, thank you to all that are here today.

The subcommittee is adjourned.

[Whereupon, at 10:42 a.m., the subcommittee recessed, to reconvene at 1:30 p.m., on February 21, 1985.]

1986 DEVELOPMENT OF ENERGY AUTHORIZATION

THURSDAY, FEBRUARY 21, 1985

House of Representatives,
Committee on Science and Technology,
Subcommittee on Energy Research and Production,
Washington, DC.

The subcommittee met, pursuant to notice, at 1:30 p.m., in room 2318, Rayburn House Office Building, Hon. Marilyn Lloyd (chairwoman of the subcommittee) presiding.

Present: Representatives Lloyd, Roe, Young, Stallings, Morrison, Fawell, and Lujan.

Staff present: Dr. Dugan, Ron Williams, Nelson L. Milder, and Tim Peckinpaugh.

Ms. Lloyd. Good afternoon, ladies and gentlemen.

Today we are looking to industry, their strong supporters in the national laboratories and the university community to inject innovative vigor into the nuclear fission R&D program so that we can revitalize the nuclear option.

Yesterday I expressed my displeasure with the department's lack of aggressiveness in pursuing the post-Clinch River initiatives in the fission R&D program. I am not interested in finding a scapegoat or identifying one particular person who is derelict, but I do believe it will take stronger leadership at the very top of DOE if we are to maintain a vital and a healthy nuclear development program.

Today we will hear about the entire spectrum of R&D activity, from the light water reactor improvement technology through the liquid metal reactor and space nuclear reactor programs, which will provide reactors in the next century.

We have ordered the panels today based on the expected chronology of payoff as the near-term, intermediate, and long-term elements of the nuclear program. The first panel on light water reactor technology improvement will delineate the modest but nevertheless important role that government can play in generic R&D to enhance existing LWR performance as well as to provide encouragement to advanced light water reactor designs which are simpler and even safer.

Our second panel involves the major players in the modular high-temperature gas-cooled reactor program, the passively safe initiative, which is very near and dear to the heart of this committee. As I understand it, the technical community has agreed on the design configuration, and I would like to hear more about that this afternoon as well as ideas on how we can best move forward programmatically and institutionally.

I made no secret yesterday that at high levels in nuclear energy at DOE there appears to be more ambivalence than decisiveness with respect to this program.

In the case of redirected breeder program, we are gratified that the department has reoriented the technology program to support innovative designs and we should like to explore in detail just how strong of a linkage exists between the technology and design activities. I am afraid that we have been presented with an OMB budget, not a DOE budget, for the liquid metal reactor program and, just as with the MHTGR, the funding does not match the programmatic thrust.

I am excited about SP-100 and related space nuclear power activities, and I believe it is our responsibility to ensure that this technology development program meets both NASA and DOD needs. We simply cannot afford to have tomorrow's civilian or defense space missions limited by power availability.

Finally, we have obtained increased cooperation from the department on the university research program which impacts the health of nuclear engineering departments around the country. Today we shall be hearing from a most informed university spokesman on these issues.

I am excited about today's hearings. They're going to be long, and I hope that the enthusiasm of the witnesses will carry over to Forrestal and up to Germantown so that the DOE will move ahead with a strong and aggressive nuclear fission R&D program.

Before I introduce the first panel of witnesses on light water reactor technology, I would like to ask the ranking Republican member, Mr. Morrison, if he would like to make any opening remarks.

Mr. Morrison.

Mr. MORRISON. Thank you, Madam Chairman. Good afternoon.

Today we build on the foundation that was set yesterday by the Department of Energy. Their budget request for civilian nuclear energy R&D programs was outlined and supported by the speakers. Today we delve into even more detail by looking at the specific nuclear energy program accounts and the impact the budget requests will have on individual laboratories.

The specific program components that we will discuss this afternoon represent this Nation's efforts to develop advanced technology concepts which can be commercialized and used on Earth or in space. We cannot be shortsighted. This Nation will need additional supplies of electricity and our major options are pretty much limited to coal and uranium. I think we all agree that we should not rely just on coal. Therefore, a credible nuclear option is critical for our future economic growth and prosperity.

Now, the nuclear R&D programs represented today—advanced light water reactor technology, modular high-temperature gas-cooled reactor programs, liquid metal reactor programs, and space nuclear—are the insurance policy we have for a secure energy future.

It would be foolhardy of us not to recognize the value of these programs and fail to support adequate funding levels. I have a particular interest in the liquid metal reactor program, and I would like to extend a warm welcome to one of my constituents, John Nolan of the Hanford Engineering Development Laboratory.

I am increasingly concerned about the pattern of reduced funding for HEDL programs, particularly the Fast Flux Test Facility and the secure automated fabrication line. Our efforts to be leaders in the world on advanced nuclear technology will surely be undermined if we don't complete and operate these programs with clearly defined missions.

I would like to suggest that we pursue well-thought-out programmatic objectives that insure that the nuclear option is preserved. We need to view the program as a whole and base our decisions on technical merit within the confines of a limited budget. That offers us, Madam Chairman, a difficult and challenging task, but I am confident that with the help of the fine witnesses before us we can achieve this goal.

Thank you.

Ms. LLOYD. Thank you very much, Mr. Morrison. Again I want to express my pleasure that you are the ranking minority member on this committee, and I think we are going to have a very good year. I think we have a very fine group of members on both sides of the aisle.

Our first panel today is comprised of Mr. Floyd Culler of the Electric Power Research Institute; Mr. James Gallagher of Westinghouse; Dr. Bertram Wolfe of GE; Mr. Jack Young of International Energy Associates, Ltd.; Mr. Ed Kintner of GPU Nuclear Corp. If you will, come up to the witness table.

You're old friends of this committee. We certainly are happy that you are here.

Now, all of your written statements will be inserted into the hearing record, and so you are free to summarize or to proceed as you wish.

Floyd, if you would like to start, we'll give you a warm welcome. I still regret you're not one of my constituents, but we're happy that you're here today, and it's always my pleasure to see you as well. Please proceed.

STATEMENT OF FLOYD L. CULLER, PRESIDENT, ELECTRIC POWER RESEARCH INSTITUTE[1]

Mr. CULLER. Thank you, Madam Chairman. It is a real pleasure again to appear before this committee. I am Floyd Culler, president of the Electric Power Institute. For 35 years prior to that I worked at Oak Ridge National Laboratory and am reasonably familiar with much of the nuclear epic. At the present time I still serve as the U.S. representative, scientific representative, to the IAEA.

EPRI performs research and development and demonstration for the private and public electric utilities of the United States, including the Federal utilities of TVA and Bonneville. EPRI and DOE coordinate programs under a formal agreement that has been in effect for 10 years, basically with——

Ms. LLOYD. Excuse me. Is your mike on, Floyd?

Mr. CULLER. The light is on. Is it all right? Thank you.

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[1] Mr. Culler's edited statement appears in the appendix to this volume.

Before we go into current development programs, I think it is desirable that we understand the current position of U.S. utilities with respect to nuclear power, and in light of the probable needs for additional electricity during the next 15 to 20 years. We must consider what directions the advanced development of light water reactors should take.

First of all, a comment or two about the need for power.

U.S. utilities stopped ordering generating plants of all types for a few years because plants ordered earlier under an environment far different than today's are judged to be sufficient to meet capacity for the next few years, perhaps until the early 1990's or maybe even a bit earlier. The utilities now face strong economic and financial disincentives to undertake any new construction for new powerplants. Recent projections, however, by DOE in support of the National Energy Plan, which you review each year, and our projections, indicate the need for significant electrical generating capacity by the year 2010, new generating capacity, perhaps an increase of as much as 50 percent.

Electricity generation will probably account for 45 to 50 percent of the primary energy consumed in the United States by approximately 2000 A.D. Assuming a growth rate that is modest by historical standards, additional generating capacity will be needed sometime as early as the mid 1990's. If these capacity needs are to be met with conventional generating units that take 6 to 8 years to build, many utilities in various regions of the United States will need to resume construction late in this decade.

This electrical capacity will be needed first of all to support economic growth, and unlike energy overall, electricity tracks economic growth and has exactly. As the GNP goes up, so goes electricity; exactly the opposite to total energy in the United States.

Second, it is necessary to provide for aging and retirement of generating plants; and third, perhaps to reduce dependence on imported and uneconomic oil and gas generation. The existing U.S.-generating electrical capacity, in a report just completed, our reports just completed for the National Electric Reliability Council, is just under 600 gigawatts. The peak demand was 448 gigawatts in July 1983, leaving a capacity margin of approximately 25 percent.

It may appear, and it's quite widely and erroneously assumed, that all of this capacity margin could serve additional demand. However, 15 percent of that capacity was unavailable because of necessary maintenance and unscheduled outages at peak, an average that has been maintained over a long period of 10 or 15 years of tracking.

This leaves an operating margin of approximately 10 percent on the national average. This operating margin is available to serve demand, and not the full 25 percent operating margin. And there are regional variations. In this area of the United States, in the Middle Atlantic region, there is a minus 4 percent operating margin in the most recent compilation.

Thus, new and replacement capacity will be needed in the short term, and several utilities have indicated in their 10-year projections through 1993, planned some new additions. Of this planned capacity, a significant proportion is at risk. You are familiar with the problems of nuclear. The troubled nuclear plants represent about 20 percent of the planned capacity. An additional 20 percent of this planned capacity is represented by coal systems that have not yet been committed or are under construction.

Thus, even in the 10-year short term, the ability of servicing demand for power is in some question. The importance of nuclear plants now under construction should be evident and is the basis for one category of near-term R&D done at EPRI and being proposed by the Department of Energy, that is, that which can assist in the completion of nuclear plants now under construction or improve the operability of those now operating.

Most of the R&D in this area is clearly the responsibility of the private sector, and it is being carried. And 95 percent of EPRI's investment and the utility investment goes to serve these near-term needs.

We must recognize, too, the positive elements of nuclear power as well as part of our background. There is a large, viable, successful, and active nuclear industry in the United States, made up entirely of light water reactors. In 1983 operating reactors produced cheaper or equal cost for electricity compared to other sources. In 1984 nuclear power represented 12 percent of the generating capacity. An additional 40 plants are still under construction. It will bring the nuclear generating capacity to 20 percent of the Nation's total electrical generating potential; 207 nuclear power stations are in operation outside of the United States, plus 163 plants now planned for construction overseas.

But the uncertainty which now surrounds nuclear power, the severe institutional problems in certain utilities and units and regulatory problems which now exist, make it unlikely that the utilities will order new reactors until there are changes in the regulatory and institutional setting which will allow utilities to operate at lower risk.

Thus, the technical questions which we will be discussing, although important in rationalizing nuclear power, are not the limiting principle upon which future decisions will be made.

An Edison Electric Institute committee has reported that recently, under present regulatory and institutional arrangements, no American utility would consider ordering a new nuclear powerplant. The costs and risks for nuclear development in the United States have become unacceptably high.

Yet, as voiced in the same report, based on past experience in the United States, on current foreign experience and economic analysis, nuclear power can again become an economical means for meeting future demands for electricity, safely and reliably, and an option that utilities can rationally consider.

Even at higher capital costs being experienced now, reactors coming on line, nuclear power will provide life-cycle costs lower than other forms of electricity. There is a high front-end loading on writeoff of nuclear power stations. Overseas, it is now the cheapest form of energy, and will remain so.

In spite of the current overriding institutional problems, the utilities make a very strong case for removing these disincentives which have led U.S. utilities to abandon commissioning of new nuclear plants. There are clearly ways technically to reduce costs, to improve reliability and safety which can be achieved through advances in LWR technology. A program of rationalization which is in progress in the private sector requires support from the Department of Energy and the Federal Government.

To realize the full potential of nuclear power it is necessary to rationalize the design and operation of the light water reactor, the only reactor types that in reality can be deployed in large number with confidence and without massive demonstration during the remainder of this century.

There is time now during this interregnum to consolidate and improve the performance of light-water reactors, to thoughtfully rationalize their excellent record with the large number of recent regulatory requirements, to standardize, to reduce costs, and to increase their availability and longevity. Reactors probably will have a lifetime of 60 or more years, technically. They're being written off in 40.

Research in these areas will primarily be the province of the private sector, but they will need DOE assistance both for studies and for experimental effort. Programs at the Electric Power Research Institute and within the industry are heavily weighted toward the developments which are urgently needed in the short term for operating reactors and those under construction.

Efforts are directed to technology for capital conservation and operating economy and for taking advantage of simple steps to improve safety characteristics. These steps include work on component systems reliability, in-service inspection, preventative maintenance, advancement in decontamination procedures, repair techniques. The most important safety experimentation in many years is that now being pursued in efforts to reduce the source term and to address the significant question of severe accident prevention, plant-life extension, and, of course, extended fuel burnoff.

Some of the near-term programs, which comprise 90 percent of the Electric Power Research Institute's nuclear program, have been and are being performed through cooperative efforts with the Department of Energy.

In addition to this urgent near-term research devoted to improving the operation of existing plants, the EPRI Nuclear Division has embarked upon an industry advanced light water program, approved by our board in December, to help assure the availability of the nuclear option in this country for the future. The program will explore possibilities for building relatively small nuclear plants to provide viable economic alternatives, if possible, for individual utilities to meet forecasted load growth.

The program will combine cooperative efforts by the utilities, EPRI, reactor vendors, architect-engineers, and the NRC. Utilities believe that maintaining the nuclear option for future deployment within a realistic timeframe requires that such plants be based upon proven technology and evolutionary improvement, but that these plants must be simplified and possess more predictable licensing and construction schedules. They also believe simplification and standardization offer oportunities to meet these goals.

Congressman YOUNG [presiding]. Mr. Culler, as you know, your full statement will be made a part of the record, and your time has expired, I understand from the staff.

Mr. CULLER. I will make my closing.

Congressman Young. Fine.

Mr. Culler. Thank you very much.

The Industry Advanced Light-Water Program is predicated on the basis that technology builds on decades of experience.

In closing, I want to comment that the proposed DOE funding for the 1986 budget request in the civilian reactor development program is an essential part of the overall programs for the future. Those advanced programs of looking at small reactors, such as PIUS, and new concepts most certainly are within the province of the Department of Energy. I believe that the Department is restructuring their programs with care, in view of the severe budget restraints. I believe that their new initiatives in the improved LWR development advanced light water reactor program areas are particularly important.

Thank you very much.

[The prepared statement of Mr. Culler follows:]

STATEMENT TO
SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION
OF THE
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
TESTIMONY ON
LIGHT WATER REACTOR TECHNOLOGY

Floyd L. Culler
President
Electric Power Research Institute
February 21, 1985

Good afternoon. I am Floyd Culler, President of the Electric Power Research Institute. EPRI performs research, development and demonstration for the private and public electric utilities of the United States, including the federal utilities, TVA and Bonneville. Work sponsored by the utilities in R&D for nuclear power is centered in EPRI, although there are special independent, but coordinated, activities such as the Institute for Nuclear Power Operations, the ad hoc IDCOR activity on reactor safety and efforts sponsored through individual reactor manufacturers and architect engineers. EPRI and DOE coordinate and cooperate in R&D where appropriate.

Prior to moving to EPRI, I worked in nuclear energy development at Oak Ridge National Laboratory for 35 years, covering in a technical sense most aspects of nuclear energy and through all levels of responsibility. During the past 18 months, I have chaired the Light-Water Reactor R&D Panel of the Energy Research Advisory Board of the Department of Energy, which presented recommendations in 1983 on LWR Safety Research and Development (DOE/S-0024) and which is just completing its report on LWR R&D to improve performance, costs, reliability and operability. (In draft).(1)

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(1) Report on LWR R&D, Draft, January 1985, Energy Research Advisory Board, LWR Panel.

My testimony will be directed to the development of advanced light water reactors only, with nothing on fuel cycle, waste disposal, regulatory practice and other subjects of importance. But it is necessary that we understand the current position of the utilities in the United States with respect to nuclear power. Thus, we can consider what directions the advanced development of the light water reactor should take to profit from the domestic and worldwide experience with this reactor type over the past 35 years.

U.S. utilities stopped ordering generating facilities of all types for a few years because plants ordered earlier, under an environment far different than today's, are sufficient to meet capacity demands for a few years yet; perhaps until about 1990 or a bit earlier. The utilities, under today's conditions, now face strong economic, financial and regulatory disincentives to undertake new construction.

Recent projections by DOE (in support of NEPP)(2) indicate the need for significant additional electrical generating capacity by the year 2010; perhaps an increase of about 50%. Electricity generation will account for 45% to 50% of the primary energy consumed in the U.S. by about 2000 A.D. With a growth rate that is modest by historical standards, additional generating capacity will be needed by the mid-90's. If these capacity needs are to be met with conventional generating units that take 6 to 8 years or longer to build, many utilities will need to resume construction during this decade.

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(2) Energy Projections to the Year 2010, October 1983, U.S. Department of Energy, Office of Policy, Planning and Analysis.

New capacity will be needed to (1) support economic growth, (2) to provide for aging and retirement of plants, and (3) perhaps to reduce dependence on imported and uneconomic oil and, at some time in the future, gas. The existing U.S. demonstrated electrical generating capacity in 1983 was 596 gigawatts.(3) Peak demand of 448 Gw was recorded in July 1983, leaving a capacity margin of 25% (national averages). It may appear, and it's quite widely erroneously assumed, that this capacity margin could serve additional demand; however, 15% of that capacity is unavailable, leaving an operating margin of 10% (national averages). Like all other major equipment and machinery, electric generating equipment requires periodic maintenance and is subject to unanticipated service interruptions and equipment failures. Thus, during 1983, and at an almost constant level for the previous ten years, some plants were out of service and unavailable for these reasons. The remaining operating margin was available to serve demand, but was not needed during the 1983 peak period.

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(3) Generating Capacity in U.S. Electric Utilities-An Update, (EA-3913-SR) Strategic Decisions Group, Electric Power Research Institute, December 1984.

Although the operating margin was not used to generate electricity, it does have important functions. First, the operating margin provides a margin of safety for daily operations. Major equipment failures or sudden demand increases cannot be accurately predicted. To respond to these events and to prevent service interruptions, part of the operating margin must be held in reserve as instantly available capacity. Second, the operating margin gives utilities flexibility to employ their most economical plants to serve customers' demand and thereby to reduce fuel and operating costs. Without an operating margin, this cost savings is lost, because all available capacity would have to be employed.

As noted earlier, new capacity will be needed and many utilities have tentative plans for new additions. Of this tentatively planned capacity, a significant portion is at risk. You are familiar with the problems of nuclear. The troubled nuclear plants represent about 27 gigawatts or 21% of the planned capacity. Nineteen percent of the additional capacity is representated by coal not yet under construction and considered at risk because of current adverse financial conditions.

Thus, even in the short term, the question of servicing the demand for power with the most economical supply is in question. The importance of nuclear plants under construction is evident and is the basis for one category of near-term R&D on

LWR's, i.e., that which can assist in the completion of nuclear plants under construction, most of which is clearly the responsibility of the private sector.

Is the nuclear option faulted?

I should note, as part of the background on nuclear power, that there is a large, viable, successful and active nuclear industry in the U.S. In 1983, operating reactors produced power cheaper or equal to other sources. (In 1983, on the average in the U.S., nuclear power cost about 3.5 cents per kwh, vs. coal at 3.5 and oil at 6.4 cents per kwh. There are significant variations region to region in costs.) In 1984, nuclear power represented about 12% of U.S. generating capacity and accounted for about 13.4% of the electricity produced in the U.S. Nuclear power--under development in the U.S. for the past 35 years--has established an impressive record in electricity supply. Last year, 87 licensed plants produced 325 billion Kwh of electric power, equivalent to the entire electrical power generation in the U.S. at the end of World War II. An additional 40 plants under construction will bring the nuclear contribution to over 20% of the nation's total. The world-wide contribution of nuclear power to electicity supply has been even more impressive. Two-hundred seven nuclear power plants are in operation outside the U.S., which produced approximately 600 billion Kwh last year, plus an additional 163 plants are under construction overseas.

But the uncertainty which now surrounds nuclear power, the severe institutional problems in certain utilities and units and regulatory problems which now exist, make it unlikely that utilities will order new reactors until there are changes in the regulatory and institutional setting which will allow utilities to operate at lower risk. An EEI committee has reported that, under present regulatory and institutional arrangements, no American electric utility would consider ordering a new nuclear power plant.(4) The costs and risks for nuclear development in the U.S. have become unacceptably high. Yet, as voiced in this same report, based on past experience in the U.S., on current foreign experience and on economic analyses, nuclear power could again be an economical means of meeting future demands for electricity, safely and reliably, and an option that utilities could rationally consider.

In spite of these current overriding institutional problems, the utilities make a strong case for removing those disincentives which have led U.S. utilities to abandon commissioning new nuclear plants. The units are not faulted, as much as the management and institutional structures. For example, recent research regarding the public risk from nuclear power plants shows that the current generation of LWR's are even safer than previously calculated. The implication of this research is that existing federal regulations--particularly those for emergency planning--are based on exaggerated scenarios of what would occur in the event of a nuclear reactor accident.

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(4) The Report of the Edison Electric Institute Task Force on Nuclear Power, February 1985, Edison Electric Institute.

The program goals of EPRI R&D for all forms of energy are to provide utilities with:

(1) technology for capital conservation and operation economy by increasing availability and lifetime of present plants (load management, conservation, co-generation, use of renewables).

(2) improved technology and flexibility to meet additional capacity requirements through use of coal, uranium and alternates in the 1990's.

(3) advanced technology, largely developed through the DOE program, to realize the full potential of nuclear power: through the liquid metal breeder to assure abundant fuel supply and through the HTGR to achieve capability to service co-generation and process heat energy demands.

The current programs at EPRI are heavily weighted toward the development of technology for capital conservation and operating economy. These programs include work on: (1) component and system reliability improvement, (2) in-service inspection and preventive maintenance development, (3) advancement in decomination processes, repair techniques, and occupational radiation exposure reduction, (4) source term and severe accident prevention, (5) plant life extension, and (6) extended fuel burnup. Many of these programs, which comprise over 90% of the EPRI Nuclear Division funding have been and are being performed through cooperative efforts with the Department of Energy. We hope that these cooperative efforts will continue and be expanded, particularly for source term research.

However, to realize the full potential of nuclear power, it is necessary to rationalize the design and operation of LWR's, the only reactor types that can be deployed with confidence and without massive demonstration. There is time now to consolidate and improve the performance of light water reactors, to thoughtfully rationalize their excellent record with the vast number of new regulatory requirements, to standardize, to reduce their cost, and to increase their availability and longevity. The private sector is supporting these activities, and a new industry-wide cooperative effort is being started by the Electric Power Research Institute.

In the private sector, the U.S. reactor vendors are continuing to develop improved versions of their current BWR and PWR Nuclear Steam Supply Systems (NSSS). In addition, some are working jointly with their overseas licensees to further refine and improve their individual designs. Each of the vendors recognizes the need for refinement of their individual designs to reduce the construction schedule and improved operational aspects of their systems. As such, they are reducing plant complexity, improving constructability and overall plant operability, and reducing capital cost.

In parallel with the vendors activities in this area, the EPRI progam addresses Advanced LWR's from the standpoint of utility requirements. Under this program, EPRI will develop a set of requirement documents based on utility operational experience of present plants that will enhance the desirable and modify, mitigate, or eliminate the undesirable features. The program will identify plant simplification measures, increase margins to enhance safety and reduce investment risk, improve operability, and increase system and component reliability. High tech application of computer/solid state/telecommunications to all aspects of control will be a major part of the program. It is expected that standardization and simplification will reduce costs and shorten construction schedules. The program will also examine and evaluate reducing the size of future LWR's in the 500 MWe range. But these efforts will be primarily for design studies and will need DOE assistance, both for the studies and for experimental effort. Some DOE funding is vitally needed to support the national interest in this technology.

To assure that the results of the program reflect the needs of utilities and are consistent with the latest available technology, the program entails cooperative efforts by electric utilities, EPRI, reactor vendors, architect/engineers and the

NRC. NRC participation is an integral part of the program. An NRC/Industry program for categorizing licensing issues for new orders has been ongoing for two years now, and as the need for NRC review of requirements documents begins, their participation will have to increase. At a recent presentation of this program to the NRC Commissioners (Februay 7, 1985), the Commissioners commended the program and endorsed the need for NRC staff support.

This program encompasses all elements of the private sector nuclear industry in the effort to reach a set of broad and ambitious goals. With only those resources available from the private sector, progress toward those goals would be relatively limited. We note with enthusiasm the intent of the DOE to participate in this program. We believe that such participation will significantly enhance the program and will permit much earlier reopening of the nuclear option.

In summary, in order for the Industry Advanced LWR Program to be successful, both the technical issues, which are treated in this program, and the institutional issues, which are not being addressed here, need to be recognized and effectively handled. It is hoped then that toward the end of this decade, the confluence of utility requirements, vendor designs, and NRC approvals of both will provide utility management the technical confidence to authorize new nuclear plants.

The Industry Advanced LWR is predicated on the basis that the technology builds on decades of experience and that no demonstration projects are needed. There are other LWR concepts under consideration with the promise of greater economic safety and environmental characteristics but with goals which require intenstive R&D, "proof-of-principle" testing, and demonstration projects. While primary emphasis in these advanced concepts is on increased passive safety characteristics and small unit power size, the utilities need to know if these concepts are capable of achieving competitive capital costs and low operating costs with high reliability. These LWR concepts are not likely to be available for deployment until after the turn of the century when other advanced reactors (LWR, HTGR, modular LMR or HTGR, LMFBR, etc.) might also be available. The DOE Civilian Reactor Development Program should be broad enough in scope to support evaluation of these options.

In closing, I want to comment on the proposed DOE FY 1986 budget request for the Civilian Reactor Development Program. I believe the Department has done a commendable job in restructuring their programs since cancellation of the Clinch River Project, and in view of the severe budget constraints. I believe that their new initiatives in the "Improved LWR Development and Advanced Light Water Reactor (LWR)" areas are particularly important.

Congressman YOUNG. Thank you very much, Mr. Culler.

Mr. Gallagher.

STATEMENT OF JAMES L. GALLAGHER, GENERAL MANAGER, NUCLEAR TECHNOLOGY DIVISION, WATER REACTOR DIVISIONS, WESTINGHOUSE ELECTRIC CORP., ACCOMPANIED BY E. PRESTON RAHE, JR., MANAGER, NUCLEAR SAFETY DEPARTMENT, WATER REACTOR DIVISIONS

Mr. GALLAGHER. Thank you, Mr. Chairman.

Congressman YOUNG. You may proceed, sir, in a manner you like. And as I mentioned to Mr. Culler, your full statement, without objection, will be made part of the record.

Mr. GALLAGHER. Thank you very much. My name is James L. Gallagher. I am general manager of the Nuclear Technology Division in the Water Reactor Divisions of the Westinghouse Electric Corp. Accompanying me today is Mr. E. Preston Rahe, who is manager of the Nuclear Safety Department in the Water Reactor Divisions.

I wish to thank you for this opportunity to offer for your consideration our assessment of the status of the technology and the needs for research and development in connection with design, construction, and licensing of lightwater nuclear powerplants.

The U.S. economy is growing at a rate significantly greater than projected. This higher growth, if it persists, could have a significant effect on our ability to meet the generation requirements necessary to sustain economic growth in the 1990's. Because the performance of nuclear powerplants continues to be competitive with that of coal-fired plants, we believe that nuclear power will continue to be an important part of our electric generation mix and any generating capacity.

Maintaining the nuclear option requires that we have reforms in three areas—design, construction, and licensing. In our view, the Department of Energy Reactor Development Program must emphasize these elements and support, but not duplicate, the activities of industry. In particular, the focus should be on a logical extrapolation of the current broad base of lightwater design, construction, and licensing, and operating experience.

Relative to design reforms, much has been made recently of the idea that it is necessary to develop a radically different lightwater nuclear powerplant design. This is inconsistent with the operating record of nuclear powerplants and tends to divert DOE efforts away from a properly focused direction for reactor development in the United States.

The safety and environmental record of light water nuclear powerplants is unparalleled. The Industry Degraded Core Rulemaking Program [IDCOR] has recently concluded, based on the latest source-term research and development results, that major changes in existing nuclear powerplant designs are not warranted. The American Nuclear Society supports this conclusion.

Furthermore, the growth of our economy will place a premium on our ability to put plants with established reliability records in operation when needed. An absolute minimum of 15 to 20 years would be required before any new reactor type could be designed and constructed and have sufficient operating experience. This is no time to spend the taxpayers' money on inventing radical new designs that are not needed and wouldn't be available in time even if they were needed.

The Westinghouse program for development of the next generation of nuclear powerplant designs, the advanced pressurized water reactor, is a major cooperative effort with Mitsubishi Co. of Japan and a consortium of Japanese utilities. We and our Japanese partners are committed to completing this advanced design and building it in Japan in the not-too-distant future.

The APWR includes essentially all the parts of the plants which may perform a safety function. Relying on the sum total of the design, construction, operating, and licensing experience available to us, we have established a number of innovative design objectives and designs: One, improved component reliability and a 90-percent availability goal; reduced plant capital cost; reduced requirements for yellowcake and separative work units; reduced operational radiation exposures to 100 man-rem per year; increased design margins; and reduced economic risks, which also reduces public risk.

The principal innovations incorporated or being considered are: extended fuel cycle times without burnable poisons; highly reliable steam generators with highly corrosion-resistant materials; core-specific power has been reduced and a moderator control system has been employed which substantially reduces fuel cycle costs; reduced peak clad temperatures for postulated reactor coolant system pipe breaks and increased margin to DNB; an emergency core cooling system that ensures that the core will not be uncovered during any small-break loss-of-coolant accident.

In anticipation of the return of the nuclear powerplant market in the United States, we at our own expense are obtaining regulatory approval of the APWR from the NRC. DOE should build on these developments in a way that supports and complements them.

Programs should have the following focus in DOE: One, simplification and incorporation of advanced features for improved constructability, reliability, and operability. Two, development of advanced technologies and applications for future plant designs: consideration should be given to a wide range of potential enhancements—advanced sensors, advanced controls, robotics. A high priority should be given to artificial intelligence applications to control room design and operation.

Such research and development efforts within the existing light water frame of reference can expedite the early application to future plants.

Next I would like to address the subject of construction reforms. Two of the most important goals we must achieve are to significantly reduce the construction capital costs and increase the discipline in the construction process. Accomplishing these goals is essential if utilities are to have confidence that a nuclear plant can be completed on schedule within a reasonable budget and be allowed to operate properly.

Standardization of plant designs is an obvious must and offers great potential in the area of reducing both capital and construction costs. Capital and construction costs can be reduced in the bulk material content of nuclear powerplants and by expanding the use of modular and prefabricated construction practices.

An example of what can be done in the modular and prefabricated construction area is the Westinghouse "Nupack" concept. In this concept, the most complex and difficult parts of the plant are fabricated in an industrial setting where a skilled and stable work force is readily available and where well-developed manufacturing controls can be applied.

Recent experience with construction quality assurance demonstrates the need for a more disciplined approach to quality assurance on the part of the industry and the NRC. Westinghouse has proposed the development of a generic integrated quality-assurance program involving a sign-as-we-go process. In this process, the ground rules for acceptance would be defined in detail before construction begins. This would introduce mutual accountability and a sense of quality ownership as the work progresses. Using the sign-as-we-go process would identify and resolve quality issues on an ongoing basis.

A computerized data base management system would provide ready access to all necessary information and a means to handle the last-minute allegation problem that is currently causing licensing delays.

We believe that research and development efforts need to be devoted to making such a process available for use in connection with new plant orders and also for use in connection with the restart of suspended projects.

Finally, I would now like to discuss licensing reform as it affects research and development. The DOE has been very supportive of the efforts to improve the licensing process. Unfortunately, the results of DOE research and development are not being reflected in NRC regulations. The results of research and development demonstrate that the current accident source terms required by NRC regulations are much more conservative than previously estimated. This has immediate implications for emergency planning in which the current source terms lead to a much larger emergency planning zone than justified.

We recommend that DOE support efforts to incorporate the results of this work in NRC regulatory requirements. The NRC has recently announced a program to identify regulatory requirements that are no longer needed or that can be relaxed. This is an opportunity for DOE to get the results of its research and development incorporated into NRC regulatory requirements.

Any regulatory process has a built-in bias in favor of the status quo. It is very important that any proposed legislation or new regulatory requirements be reviewed to ensure that they do not provide disincentives for improvement. In the current draft of the NRC severe-accident policy, there is a provision that would continue the practice of the NRC to issue PDA's, preliminary design approvals, which some commissioners feel are no longer needed.

The PDA facilitates the development of improved designs by providing a mechanism for obtaining feedback from the NRC as the design proceeds prior to leading to a formal agreement on the acceptability of the design concepts. Eliminating the PDA would make major improvements, such as our APWR Program, impossible.

DOE should provide support in this area to ensure that there remains as much incentive as possible to develop and implement future design improvements.

In conclusion, I want to thank you again on behalf of myself and the Westinghouse Electric Corp. for this opportunity to appear before you to express our views on light water reactor research and development programs. We respectfully request your support in the areas which I have outlined. Thank you.

[The prepared statement of Mr. Gallagher follows:]

TESTIMONY OF JAMES L. GALLAGHER
GENERAL MANAGER
NUCLEAR TECHNOLOGY DIVISION
WESTINGHOUSE ELECTRIC CORPORATION

My name is James L. Gallagher. I am General Manager of the Nuclear Technology Division in the Water Reactor Divisions of the Westinghouse Electric Corporation. Accompanying me today is Mr. E. Preston Rahe, Jr. who is Manager of the Nuclear Safety Department in the Water Reactor Divisions. I wish to thank you for this opportunity to express our views regarding light water reactor research and development. Westinghouse is a world leader in nuclear technology, having been continuously involved in the development of the applications of that technology for power generation since its inception. I personally have been directly involved in the development, design, construction and management of nuclear power plant projects for both the domestic and international market for over 20 years. Based on this extensive experience, I offer for your consideration our assessment of the status of the technology and the needs for research and development in connection with design, construction and licensing of nuclear power plants.

THE NEED FOR NUCLEAR POWER

Economic projections made over a year ago led us to conclude that over the period from 1983 to 1990 our economy would grow at a rate of about 3.3 percent per year and that electricity demand would grow at a comparable rate. Based upon these projections and then existing reserve margins, we concluded that very few orders would have to be placed for new generating capacity of any kind required to go on-line in this time frame. Others in the industry made similar projections.

In 1983, the U.S. economy grew at a rate of 3.7 percent and in 1984, it grew at an even faster rate of about 6.8 percent. The average economic growth rate over these two years, 5.2 percent, was significantly greater than the rate we and many others had projected. The average rate of growth in demand for electricity, about four percent, was also much higher.

This mismatch between the recent performance of our economy and the projections made over a year ago will not affect the supply of electricity that Americans will require over the next five years, although there may be some spot shortages requiring peaking unit additions. If this mismatch persists, however, it could have a significant effect on our ability to meet the generation requirements necessary to sustain economic growth in the 1990s. In fact, if this mismatch continues, as we and others believe it will, it is essential that utilities begin to plan for new generating capacity now.

Nuclear power is an important and growing part of our electric energy mix. In 1983, it was the source of 12.6 percent of the electricity consumed in the U.S.; by 1990 we expect that it will make an even greater contribution, about 20 percent, to supplying our needs. This electricity will be supplied by the 83 plants now in operation and the 49 in startup, still under construction or on order. Because the performance of nuclear power plants continues to be competitive with that of coal-fired plants, we believe that nuclear power will continue to be an important part of our electric generation mix and any growth of generating capacity.

Maintaining the nuclear option requires that we have reforms in three areas -- design, construction and licensing. The development activities of Westinghouse and others in the industry have their foundation in these areas. In our view, the Department of Energy

(DOE) reactor development program must emphasize these elements and support but not duplicate the activities of the industry in advancing these reforms. In particular, the focus should be on advancing the technology in these areas in a logical extrapolation of the current broad base of light water design, construction, licensing and operating experience.

DESIGN REFORMS

Much has been made recently of the idea that it is necessary to develop a radically different nuclear power plant design to resuscitate the nuclear industry. This is inconsistent with the operating record of nuclear power plants. These calls for radical changes have created an atmosphere of overreaction and tend to divert DOE efforts away from a properly focused direction for reactor development in the U.S.

I believe that no radical new reactor concept is required or appropriate to meet public or industry needs. The safety and environmental record of nuclear power is unparalleled and nuclear power plants are competitive with coal in terms of the overall cost of power production. Source term research, spurred on by the evaluations of the events at TMI, has confirmed that the margins of safety provided by the current source terms together with the defense in depth philosophy of design are much greater than they were previously believed to be. The Industry Degraded Core Rulemaking Program (IDCOR) has recently concluded, based upon one of the most intensive evaluations of nuclear power plant risk, that additional major design or operational changes in existing nuclear power plant designs are not warranted. An independent peer review of the IDCOR results by the American Nuclear Society supports this conclusion. Furthermore, the anticipated growth in electric power demand will be needed to fuel the continued growth of our economy, and will place a premium on our ability to place plants with established reliability records in operation when needed. Our experience is that an absolute minimum of 15 to 20 years would be required before any new reactor type that we might begin to develop now could be designed and constructed and sufficient operating experience obtained in order to be deemed commercially viable. This is no time to spend the taxpayer's money on inventing radical new designs that are not only investment intensive (in excess of one billion dollars) but are not needed and wouldn't be available in time, even if they were needed. This is particularly true, given that U.S. firms such as ourselves and the General Electric Company are spending their own money developing improved designs, building on our experience to date.

The Westinghouse program for development of the next generation of nuclear power plant designs -- the Advanced Pressurized Water Reactor (APWR) -- is a major cooperative effort with the Mitsubishi Company of Japan, one of our licensees, and a consortium of Japanese utilities. We and our Japanese partners are committed to completing this advanced design and building it in Japan in the not too distant future. Our incentive for developing this design is the need to remain competitive in international markets. While we jointly have committed over $100 million to this effort, the lack of new orders in the U.S. has precluded us from undertaking this project alone.

The design of the APWR includes not only the nuclear steam supply system but also essentially all of the parts of the balance of plant which may perform a safety function, thereby ensuring that all safety systems perform as an integrated whole. For this design, we looked at the sum total of the design, construction, operating and licensing experience available to us, including the results of TMI. Then, starting with a clean sheet of paper, we set out to identify design changes with the primary emphasis on simplicity and reliability. This has resulted in establishing design objectives such as:

1. Improved Component Reliability and 90 Percent Availability
2. Reduced Plant Capital Cost ($/KWE)
3. Reduced Requirements for Yellowcake (23%) and Separative Work Units (30%)
4. Reduce Occupational Radiation Exposures to 100 Man-Rem Per Year
5. Increased Design Margins
6. Reduced Economic Risk (Also Reduces Public Risk)

Over 40 new patents have been obtained on unique design features developed through this process. The following principal innovations have either been incorporated or are being considered for incorporation in the APWR:

1. Extended fuel cycle times (18 to 24 months) without the use of burnable poisons. The longer fuel cycle time significantly reduces the total down time for refueling and the occupational exposure from refueling operations. Likewise, highly reliable steam generators are expected to provide significant reductions in maintenance time and occupational exposures. These steam generators will incorporate highly corrosion resistant materials, and have significantly reduced tube stresses.

2. Fluid and electrical systems have been simplified, significantly reducing space, equipment, piping, and wiring requirements. Major reductions in construction costs are also expected because construction of the APWR will not be initiated until the design of safety related parts of the plant are sufficiently complete and approved by the regulatory authorities.

3. Core specific power has been reduced and a moderator control system is employed which substantially reduces fuel cycle costs.

4. Increased reactor coolant inventory above the core and the reduced core specific power increase design margins by reducing the peak clad temperatures for postulated reactor coolant system pipe breaks and increasing the margin to DNB for all reactor transients. These increases in design margins help to provide greater flexibility in operation without encroaching on safety margins.

5. Improvements incorporated in the design of the emergency core cooling system ensure that the core will not be uncovered during any small break loss of coolant accident. This significantly reduces the risk of economic loss from such events while at the same time almost eliminating the potential for release of radioactivity from the core as a result of such events.

In anticipation of the return of the nuclear power plant market in the U.S., we are, at our own expense, obtaining regulatory approval of the APWR from the NRC.

DOE reactor development efforts should not duplicate these privately financed developments, which have a solid foundation in the current technology and experience base. Rather, DOE should build on these developments in a way that supports and complements them. In this regard, any research and development programs should have the following focus:

1. Simplification and incorporation of advanced features for improved constructability, reliability, operability, maintainability, and reduced plant cost; and

2. Development of advanced technologies and application for future plant designs. Considerations should include a wide range of potential enhancements - advanced sensors, controls, robotics, etc. A high priority should be given to artificial intelligence applications to control room design and operations. Expert systems in this area have an exciting potential for:

(a) Developing optimum procedures for plant operators in connection with routine operation and maintenance, and

(b) Assisting the plant operator in maintaining the plant in a safe condition while recovering from a system or component failure

Direct focus of such research and development efforts within the existing light water reactor frame of reference can expedite their early application to future plants.

CONSTRUCTION REFORM

Two of the most important goals we must achieve in the next generation of nuclear power plants are to significantly reduce construction capital costs and to increase discipline in the construction process. Accomplishing these goals is essential if utilities, public utility commissions, and the financial community are to have confidence that a nuclear plant can be completed on schedule within a reasonable budget, and be allowed to operate promptly so that it can begin to earn a return on the capital investment. Without this confidence, no utility will be able to place an order for a nuclear power plant.

Standardization of plant designs, which I have already discussed in the context of design reform, is an obvious must and offers great potential in the area of reducing both capital and construction costs. Much has already been done in this area, but there is a need to have the designs of these standardized plants completed to the point where they can support a one-stop licensing application at the NRC. Here, it is important to recognize that this will require the design to be complete enough for a complete specification of the tests, inspections, and analyses together with the specific acceptance criteria necessary to ensure that the plant as constructed will satisfy all the requirements upon which operation is contingent. I will address this aspect further when I speak of the need for increased discipline.

Capital and construction costs can be reduced by reducing the bulk material content of nuclear power plants (eg., concrete, steel, wiring, etc.) and by expanding the use of modular and prefabricated construction practices. Both of these warrant serious attention in DOE research and development programs.

An example of what can be done in the modular and prefabricated construction area is the Westinghouse "Nupack" (nuclear packages) concept adapted in part from the Westinghouse floating nuclear power plant design, which has received a manufacturing license from the NRC. In this concept, the most complex and difficult parts of the plant are fabricated in an industrial setting where a skilled and stable work force is readily available and where well developed manufacturing controls can be applied.

The "Nupack" concept involves four modules; a reactor barge package, a reactor auxiliary barge package, a turbine-generator barge package, and a turbine-generator auxiliary barge package. Each of these is an integrated, enclosed steel structure similar to a barge in that each is watertight and will float, although it is intended that they be delivered to the site on transporter barges. Once delivered to the site, the packages would be floated into position and set on foundations.

Increased certainty about cost and schedule as well as a predictable high level of quality would result from the use of this concept or any other utilizing modular and prefabricated construction methods. The greater continuity in the management and labor work force, the use of permanent facilities, the exploitation of modern fabrication techniques, and the benefits of a learning process stemming from an assembly line method of production will all improve productivity, cost control, schedule control, and lead to lower overall costs and shorter plant lead times.

Recent experience with construction quality assurance and the handling of last minute allegations demonstrates the need for a more disciplined approach to quality assurance on the part of the industry and the NRC. In this regard, Westinghouse has proposed the development of a generic integrated quality assurance program involving a different, innovative, more disciplined and methodical approach. Through a team approach, industry and the NRC would review and sign off on the actual work as work progresses instead of waiting until construction is completed -- a "Sign-As-We-Go" process.

The necessary up-front discipline would be introduced in this process by defining the ground rules for acceptance in detail before construction begins. First we would identify and agree on the necessary inspections, tests and analyses together with the corresponding detailed acceptance criteria. Then we would agree in advance on an inspection plan including the requirements for supporting documentation, the required levels of sign-off (by craft inspectors, licensee inspectors, NRC inspectors), and any required hold-points. This would introduce mutual accountability and sense of quality ownership as the work progresses. Using the "Sign-As-We-Go" process would identify and resolve quality issues on an ongoing basis. As a part of this approach, a computerized data base management system would be developed to provide ready access to all necessary inspection, test and analysis information including the status of the acceptance of components, systems and structures at any time. This would also provide a means to handle the last minute allegation problem that is currently causing licensing delays by providing tools to quickly research and identify problems in order to assess their validity and to establish any appropriate corrective actions which warrant attention. We believe that research and development efforts need to be devoted to making such a process available for use in connection with new plant orders and also for use in connection with the restart of suspended projects.

LICENSING REFORM

The DOE has been very supportive of efforts to improve the licensing process, both in terms of administrative and legislative reform and in identifying NRC regulatory requirements that, based on the latest technical information, are unnecessarily conservative or no longer necessary. Unfortunately the results of DOE research and development are not being reflected in the regulations. A current opportunity for incorporating the results of research and development into NRC regulatory requirements is now afforded by the work that has been done which demonstrates that current accident source terms required by NRC regulations are much more conservative that previously estimated. This has immediate implications for emergency planning, in which the current source terms lead to much larger emergency planning zones for nuclear plants than would be justified if more realistic source terms were to be utilized. We recommend that DOE support efforts to resolve any remaining technical questions that may stand in the way of incorporating the results of this work in NRC regulatory requirements. We also recommend that there be a concerted effort to review the results of other research and development performed to date to identify areas where regulatory requirements should be modified. The NRC has recently announced a program to identify regulatory requirements that are no longer needed or that can be relaxed. This is an opportunity for the DOE to get the results of its research and development incorporated in NRC regulatory requirements.

It is important to recognize another important relationship between the licensing process and the continuing development of the technology. Any regulatory process has a built in bias in favor of the status quo. Once regulatory approval has been obtained for an activity, there is a strong disinclination to do anything that would upset that approval and require re-review. It is very important that any proposed legislation or new regulatory requirements be reviewed to ensure that they do not provide disincentives for improvement. The NRC is currently struggling with their long awaited severe accident policy. In the current draft of the policy, there is a provision that would continue the NRC practice of issuing preliminary design approvals (PDAs). This has drawn fire from some of the Commissioners who have expressed the opinion that a PDA is no longer needed if the Commission plans to require essentially complete design information before issuing construction permits in the future. In taking this position, they overlook a very important and practical problem that the issuance of a PDA addresses. The problem is that no utility, reactor vendor or architect-engineering firm can afford to invest the hundreds of millions of dollars required to develop an essentially complete design without a process for obtaining feedback from the NRC as they proceed with the design. Such a process must lead to a formal agreement on the acceptability of their new design concepts before the detailed design work has been done. Furthermore, the PDA is very important in the international market place where potential customers seek assurance that new designs are at least licensable in the country of their origin, because it provides U.S. suppliers with sound basis for competing with suppliers in other countries. Eliminating the PDA would not only make major improvements such as our APWR impossible but would place U.S. suppliers at a serious disadvantage in international markets where major improvements are a competitive must. Rather than eliminate the PDA, we believe that the NRC should go even further than it has. In addition to continuing to grant PDAs, the NRC should adopt a policy of issuing advisory opinions as to the licensability of nuclear plant improvements. DOE should provide support in this area to ensure that there remains as much incentive to develop and implement future design improvements.

In conclusion, I want to thank you again on behalf of myself and the Westinghouse Electric Corporation for this opportunity to appear before you to express our views on light water reactor research and development programs. We respectfully request your support in the areas which I have outlined. Mr. Rahe and I would be pleased to respond to any questions you may have at this time.

JAMES L. GALLAGHER

General Manager, Nuclear Technology Division
Water Reactor Divisions
Energy and Advanced Technology Group
Westinghouse Electric Corporation

James L. Gallagher was appointed General Manager, Nuclear Technology Division of the Water Reactor Divisions of Westinghouse in 1984.

In his present position, Mr. Gallagher is responsible for Westinghouse's pressurized water reactor engineering activities including systems development, design analysis and integration; all phases of safety analyses, licensing, reliability and risk analysis; and, the quality assurance support for the Business Unit. The Water Reactor Divisions comprise over 10,000 people located in 13 countries around the world.

Mr. Gallagher has 20 years experience in the nuclear industry starting as a Systems Design Engineer in 1963. He has held a number of management positions in the area of systems design, nuclear safety, and strategic planning, and has had 2 tours of duty in Europe; during 1971 and 1972 he was Systems Engineering Manager for Westinghouse Nuclear Europe in Brussels, and between 1977 and 1982 he was responsible for the Westinghouse Nuclear Operations in Spain, located in Madrid.

Mr. Gallagher received a BS and an MS Degree in Chemical Engineering from the University of Pittsburgh.

Mr. Gallagher is married and has three children. The Gallaghers live in the Pittsburgh suburb of Wexford.

Congressman YOUNG. Thank you very much, Mr. Gallagher.

Dr. Bertram Wolfe will be our next witness, from General Electric Co.

Doctor, you may summarize in a minute if you would like, sir.

STATEMENT OF DR. BERTRAM WOLFE, VICE PRESIDENT AND GENERAL MANAGER, NUCLEAR TECHNOLOGIES AND FUEL DIVISION, GENERAL ELECTRIC CO.

Dr. WOLFE. I will summarize the written testimony, Mr. Young.

My name is Bertram Wolfe. I am vice president of General Electric and general manager of its Nuclear Technologies and Fuel Division. In this capacity I am responsible for GE's advanced nuclear technology efforts. I have been in the nuclear power business over 25 years and watched the change from robust growth of orders and expectations in the sixties to the current period of hiatus and uncertainties.

I want to thank the subcommittee for your invitation to participate in these important hearings, and I would like to direct my testimony to possible developments in the United States that could aid the future course of nuclear power.

You've heard from Mr. Culler and Mr. Gallagher about the institutional problems in the United States. I spent almost all of my testimony discussing them. I think they're clearly a cause of concern, and without correcting them I think we're going to have trouble developing any type of nuclear energy program in this country or continuing the introduction of new nuclear plants.

In view of this situation, one might ask whether it makes sense even to continue considering new nuclear plants in an environment where even plants, dozens of which have been built in the past, can't even operate when they're built, as we've seen in Long Island.

We think that the institutional problems should be attacked, and attacked directly. We have supported new licensing initiatives, and programs such as the Atomic Industrial Forum have proposed, in looking at arrangements between architect-engineers, utilities, reactor manufacturers and so on, new ways of building reactors and such, and certainly new licensing, again new licensing arrangements.

But we think there's room and a role for advanced technology to help in overcoming the institutional problems. We think, in fact, that any initiative on new reactors based on advanced technology really must address the institutional problems as part of the development. Today I am pleased to be a member of three panels talking about light water reactors, HTGR's, and LMR's, and I would like to summarize our philosophy with respect to all three before talking about the light water reactor on this panel.

Basically, we've attempted, in looking at advanced concepts, to address three or perhaps four institutional problems which we think can be helped by advanced technology.

The first is safety, and the licensing problem. In each of the concepts which I will describe today we've made an attempt to shrink the safety envelope to try and make the safety envelope as close to the reactor and reactor assembly as possible and to exclude from safety considerations the balance-of-plant, so that one would hope that one could build the balance-of-plant to very high quality but not to regulatory requirements, and could eliminate the present kind of situation where utilities tell us today that there are as many as a ratio of 1 to 1 in terms of manual workers at a reactor site to quality-control overseers at the site.

Second, we've made an attempt in each of these concepts to develop factory production and assembly of systems and subsystems, in particular in the reactor systems themselves. And this factory production offers the potential of a much greater degree of automation, a cost-reduction learning curve which we've seen in factory production but which we haven't seen in field work in the past, and perhaps as important as anything else, more efficient quality- and control-assurance practices and, in particular, documentation of the quality assurance.

Third, and perhaps most important of all in terms of new concepts, is to reduce the costs of development of the concepts. We worked hard and diligently with our other partners on Clinch River, and we supported it and we're sorry to see its demise.

But despite our enthusiasm for Clinch River, it seems clear to us the time is past where we can expect to get $5 billion or $6 billion demonstration programs which don't lead to a commercial product but really lead to an invitation, if successful, for the next of the $5 or $6 billion programs, such as is going on in Europe and Japan today.

We supported Clinch River. We thought that was a viable way to go. It was a viable way to go in this country a decade or two ago. We don't believe it's a viable way today. And so our approach is to try to find ways of developing these new systems and to tailor these new systems so that they can be developed on reasonable time scales—not decades, many decades, but less—and not billions of dollars but, hopefully, hundreds of millions of dollars or less.

And finally—and here is where I said three or four—we have a fourth item that sort of comes out from the other three, but it might well be set as a goal itself; and that is, to reduce the size of the systems, the power rating of the systems, so that it perhaps more nearly fits into the utility requirements today with lower load growths than we've seen before and with a lower commitment of total resources. So we've been looking at reactors in the 500- to 600-megawatt range and below, and I will discuss those in my testimony on all three panels.

We are looking at three different concepts, phased in time, as we would see it, much as Chairman Lloyd indicated; that is, the lightwater reactor, the HTGR, and the LMR. Each of these concepts, we believe, shows promise of meeting the objectives I have just indicated. All of them require additional work and assessment before success can be predicted with assurance. And I would like to point out or describe these concepts on the panels.

I would like to start for this panel, obviously, with the lightwater reactor concept. We have developed an innovative BWR that we believe promises potential in the following areas. First, with respect to Mr. Gallagher's concept points, our concept retains the basic design characteristics and attractive features of our boiling-water reactor and is not really a major extension of technology so that one is unsure of the technological basis of the concept.

We've included all of the advancements of our advanced boiling-water reactor being developed in Japan, on which we and our partners, Hitachi and Toshiba and the Tokyo Electric Power Co., have spent in development and design over $150 million to date, and have included all of our experience from our BWR's, BWR-6 design, and its extensive licensing effort and our GESSAR license that we've been working on and have been awarded by the NRC a standardized license.

The principal design innovation which we've come up with is both an isolation condenser for emergency cooling which exhausts into our suppression pool and an elevated water suppression pool that, under accident and emergency conditions, serves as a water source for a gravity-driven emergency core cooling and shutdown system. It's an in-containment heat sink. It has enough capacity for several days of storage of the reactor shutdown heat system without any operator action.

All of the reactor protection systems are contained within a compact concrete containment structure. They require no pumps or auxiliary power for activation of the protection system, and we believe no operator action would be required under any of the emergency systems for about 72 hours, after which the suppression pool would be losing some water and one would have to take a garden hose and attach it to a nipple on the outside of the building to refill, to continue filling the pool.

We're enthused about this kind of a concept, and we have described it in the American Nuclear Society meeting last November. If it meets with your approval, I would like to submit that paper to the committee for your records.

Congressman YOUNG. Without objection, it will be made a part of the record, Dr. Wolfe. Thank you.

Dr. WOLFE. I would emphasize that while we believe our efforts to date are promising and we have discussed them with DOE and with other agencies here in Washington and with the staff of your committee, we want to indicate that our efforts have been limited and, as such, they are incomplete and inconclusive.

We have suggested to DOE informally that there be a relatively modest 2-year design and key component development program that could verify the economic potential of this approach and identify any major problems, including a key problem of exploring the potential of gaining new licensing criteria and determining the follow-on efforts necessary to proceed toward commercialization.

We will be submitting a proposal to DOE in the near future along those lines.

Mr. Chairman, thank you for your attention, and I will be happy to answer any questions you may have.

[The prepared statement of Dr. Wolfe follows:]

TESTIMONY OF

BERTRAM WOLFE

VICE PRESIDENT AND GENERAL MANAGER

NUCLEAR TECHNOLOGIES AND FUEL DIVISION

GENERAL ELECTRIC CO.

Madam Chairman and other Members of this Subcommittee:

My name is Bertram Wolfe. I am a Vice President of the General Electric Company and General Manager of its Nuclear Technologies and Fuel Division. In this capacity, I am responsible for GE's advanced nuclear technology efforts. I have been in the nuclear power business for over 25 years and experienced the change from robust growth of orders and expectations in the sixties to the current period of hiatus and uncertainty. I want to thank the subcommittee for your invitation to participate in these important hearings and will direct my testimony to possible developments that could aid nuclear power in the future in the U.S.

Our Power Systems Sector Vice President, Mr. L. V. Tomasetti, closed his presentation to the Atomic Industrial Forum Annual Conference in November last year with the comment, "Someday in the future American utilities will be able to build a nuclear power plant for a predictable cost . . . complete it in a predictable period of time . . . and operate it at a predictable and competitive number of cents per kilowatt hour. It will be at that time . . . and not before . . . that the future of the American Nuclear Power Industry will again be predictable."

In a similar vein, the utility participants in an Atomic Industrial Forum study team, of which I was a member, insisted that the executive summary of our report start out with the statement: "Nuclear power cannot at this time be considered a viable option on which to base new electricity capacity in the United States." This AIF study, "Nuclear Power in America's Future", went on to conclude that the primary problems of nuclear power "are for the most part institutional as contrasted to technical". In my testimony of last year I discussed at length some of the institutional problems which have impeded the progress of nuclear power in the U.S., and I indicated that fundamental to revival of nuclear power in the U.S. is the correction of unnecessary and unproductive institutional impediments.

Among the key impediments are the excessively complex, time consuming and unpredictable licensing and regulatory processes. Coupled with this are costly and uncertain financing arrangements which have led to expensive project schedule stretchouts.

Nuclear construction requires not only excellence of workmanship, but record keeping that far exceeds that of other industrial construction projects. The record keeping stems from the necessity to prove, sometimes to hostile intervenors, that the practices, procedures and the work itself were rigidly performed to NRC specifications and regulations. This has led to indirect costs for nuclear plants that are two or more times higher than fossil plants and site craft labor costs that sometimes exceed three times those of fossil plants. In foreign countries we and others have proven our ability to reduce excessive costs associated with nuclear construction, but, we have not found the means to consistently accomplish this in the United States, within our present institutional infrastructure.

One direct approach to the problem is of course to adopt new institutional approaches. We have advocated this, and support new licensing legislation, new financing approaches, and, as the AIF report suggested, an examination of new arrangements and responsibilities for government bodies, utilities, architect engineers, and reactor manufacturers involved in the nuclear endeavor.

In addition, however, technological innovation - new reactor approaches should be examined. This may seem surprising. One may logically ask whether it is possible to develop new reactor systems in the U.S. when, as indicated above, it does not seem possible to construct witn predictable costs or schedules reactor systems of which dozens have already been built and operated.

The answer, we believe, is that the new approaches must not only lead to improved economic and technical performance, but must do it in a way which responds to the institutional barriers, and lowers them.

We have identified three basic technological objectives oriented towards lowering the institutional barriers. I am going to discuss these objectives and then describe three advanced systems which are responsive to them.

REDUCE SAFETY COMPLEXITY

Before I begin a discussion of our objective with regard to safety, I want to emphasize that our present LWRs have already achieved a level of safety unmatched by other power sources, indeed, unmatched by most large scale industrial endeavors. Our goal is not to correct a safety deficiency of our current LWR designs, but rather to achieve the high level of safety assurance required in a different way and at a lower cost.

Our current designs involve numerous redundant engineered safety systems, an approach commonly called defense in depth. This has been one cause of the proliferation of regulations governing the construction of nuclear plants and has contributed to the excessive escalation in nuclear plant costs. The cost increase is not so much for doing the job right, but providing records and proof that hundreds of subsystems and thousands of components meet the objective and detail of these regulations. Utilities with plants under construction report that a ratio of one non-manual worker for every two manual workers is now common at nuclear construction sites.

One approach to this problem is to constrain the nuclear safety related envelope to a self-protecting reactor assembly so that the balance of the steam and electrical producing plant, the main part of the plant, can be constructed to high quality but non-NRC regulated practices commensurate with the need for economic reliability. We believe this can be made practical with designs employing inherent passive reactor protection rather than multiple, engineered systems that require activation and site power for operation.

INCREASE PREFABRICATION OF SYSTEMS

That the cost of all power plant field construction, not just nuclear, has escalated at a rate far in excess of inflation is well known. For instance, over the past 20 years coal plant costs have increased by more than a factor of ten, more than three times the increase in the consumer price index.

In contrast, factory produced systems such as reactor vessels and installed internals have experienced an escalation rate lower than inflation. The argument for more factory production of systems seems compelling.

Therefore, our second objective is to develop a standard design which maximizes the systems that can be factory produced, assembled and shipped to the site for rapid installation. We believe this can reduce and control costs for all plant systems and especially the nuclear assembly. Factory production offers the potential of a greater degree of automation, a cost reduction learning curve with repetitive production and much more efficient quality control and assurance practices, procedures, and documentation.

AFFORDABLE DEMONSTRATION WHICH CAN LEAD TO STANDARDIZATION

Recent experience in the development and demonstration of new nuclear technologies has involved costs in the billions of dollars and times in decades. The recently cancelled Clinch River Project, which we worked on and supported, had estimated completion costs of 1.5 billion dollars after expenditures of 1.7 billion, and if successful would have required many billions of additional development dollars before commercialization was possible. It is unlikely that development projects of this size and duration can be funded in the foreseeable future.

While the cost of developing new technologies presents a formidable obstacle, the need for demonstrating their viability has never been so clear. The costs of building even well developed light water reactor plants in the U.S. currently vary by a factor of three with some exceeding 4000 dollars a kilowatt. In view of this experience, it is doubtful that any new type of plant would be committed, regardless of its promise, without firm assurance that the cost is reasonable and can be controlled. In fact, as Mr. Tomasetti noted, it is unlikely that new U.S. nuclear orders will commence even for current designs unless we find some means of demonstrating that costs and schedules can be predicted and controlled.

Therefore, our third objective is the reduction in demonstration costs for a new system, and if successful, the promise of introduction of a new standardized system with predictable costs and schedules. The demonstration can vary from proof of passive safety systems for a new commercial LWR plant, to full scale safety tests of advanced reactor systems. In any event, the demonstration must result in assured reduction in the need for current regulatory review and overview and assurance that new construction practices and procedures can yield quality products with predictable and competitive economics.

General Electric is currently evaluating three new concepts that to varying degrees address the three primary objectives. Each shows promise of reducing plant costs and schedules but none has progressed to the point where success can be predicted with assurance. All require additional work and assessment.

INNOVATIVE BWR

Over the past two years we have studied design modifications to our BWR technology that promise inherent reactor protection as compared to current designs. In the event of an accident these new designs can eliminate the need for safety grade pumps, diesels, many support systems and any operator action for several days. As a result, it would seem that much of today's complex regulatory review and overview requirements can be reduced.

We have looked at an approximate 600 MWe nuclear steam supply system. The principal design innovation is an elevated pressure suppression pool that provides natural convection shut down heat removal to an isolation condenser and a gravity driven emergency core cooling and liquid poison back-up. All reactor protection systems are contained within a compact concrete containment structure and require no pumps or auxiliary power for valve actuation.

We believe that a combination of design, analysis, component development and a safety analysis approved by the Nuclear Regulatory Commission could lead to a final design approval. A key advantage is that much of this effort will be similar to our recent GESSAR standard licensing effort and will incorporate many of the Advanced Boiling Water Reactor features we are developing in cooperation with Japanese utilities.
As a start we suggest a relatively modest two year design and key component development program. The objective is to verify the economic potential of this approach and identify any major problems. We have discussed this possibility with the Department of Energy and request you give this due consideration in your FY86 budget mark-up.

MODULAR HTGR

We are pleased with the recent redirection of the HTGR program toward the pebble bed fuel, modular concept and the developing recognition of the need and value of a safety test of this concept. As compared to the 1000 MWe designs of the past, the small modular reactor concept offers the benefit of low development cost, and the ability to expand a site's capacity to any level at a rate consistent with the utility's growth demand. We believe a safety test of a standard module is mandatory if the U.S. is to capitalize on the promising self-protecting features of the small pebble bed HTGR reactor.

The HTGR must be small to realize its full self-protecting potential. This is so because fuel temperatures must be restricted to prevent fission product release, and under accident conditions this can be assured by a relatively short heat transfer path from the fuel bed center to the reactor vessel. Factory production of the reactor assembly and licensing advantages are expected to offset to a large degree the diseconomy of scale of the small reactor. Building the balance of plant to conventional, non-nuclear standards on a short schedule of 3 to 4 years should provide additional cost savings.

We recommend that the conversion of the HTGR program from a large plant to a modular plant focus be accelerated, and that government agreements be reached covering direct utilization of the extensive HTGR developments in the Federal Republic of Germany. From our contacts and effort, we are hopeful that a satisfactory agreement can be reached that would allow modification of this technology to meet U.S. requirements. This would eliminate the need to repeat much of the design and development effort already accomplished in West Germany. We are focusing our efforts on the side-by-side design because it promises improved reliability, maintenance and a simpler reactor design. When the details of this approach can be compared with other alternates a decision can be made on the best design approach for the U.S. HTGR program.

MODULAR LMR

We are pleased to have been selected as one of the two contractors for the study and assessment of small innovative liquid metal reactor (LMR) designs. Our efforts to date indicate the modular LMR approach we call PRISM could be a solution to the high capital cost of breeder reactors and their high cost of development; and could ultimately yield a power system whose fuel supply can be maintained indefinitely. While innovations in light water reactors or possibly the modular HTGR could be the system of choice for the intermediate term, the world and the U.S. will ultimately need the breeder.

Our studies to date indicate that a small liquid metal reactor can be designed to be self-protecting so that design temperature limits are not exceeded during any accident conditions. Matching the reactor power level to the surface area of its containment vessel permits shutdown heat removal with free convection of air over the containment. A small reactor can be designed to shut itself down in events such as loss of heat sink without scram, loss of primary coolant flow without scram and inadvertent control rod withdrawal so that design temperature limits of the reactor structure or its components, are not reached. Once demonstrated, such characteristics can justify greatly reduced plant and site regulatory requirements and consequently plant capital costs.

Cost estimates based on the presently anticipated nuclear and conventional grade materials and systems for our PRISM plant show promise that this concept can be cost competitive. We expect a relatively high capacity factor and moderate operation and maintenance costs. The primary basis for such expectations is reliance on rather simple passive design features that eliminate the need for complicated multiple active safety systems.

The principal barrier to an intermediate application of the LMR is its need for fuel reprocessing. While reprocessing technology is probably much less of a barrier than political considerations, more effort needs to be devoted to resolving current technical and political problems. We are presently working with government laboratories to scope out closed fuel cycles for the PRISM LMR.

Each of the three concepts I have only briefly described promise the potential of a definitive separation of NRC regulated safety work from high quality conventional work and a reduction in the higher cost regulated portion. All have the potential for increasing the percentage of the plant that is factory produced and reducing the site direct and indirect labor effort. None require any major technical breakthroughs but all require more design, analysis and critical assessment of their realistic potential in achieving meaningful cost and schedule reductions. And, all involve the risk that our regulatory agencies will maintain their current demand for redundant engineered safety systems regardless of the inherent passive protective features provided, risks that our cost reductions expectations will not be fully realized as we progress from conceptual to final designs, and risks that future government policies will not be supportive of nuclear power regardless of its economic promise.

The programs are specifically oriented to minimize the cost of developing new systems. We believe it is important to investigate, assess and develop such concepts that address the major barriers to economic nuclear power encountered to date. We are pleased with DOE's redirection of resources in support of innovative concepts and hope such efforts will be expanded.

Madam Chairman and Subcommittee Members, I hope the comments above are of use to you.

DR. BERTRAM WOLFE

Vice President & General Manager
Nuclear Technologies and Fuel Division
General Electric Company

Dr. Wolfe received his B.A. in Physics from Princeton University in 1950 and his Ph.D. from Cornell University in 1954. He has been in the nuclear energy field since 1955, working all but two years at General Electric. Dr. Wolfe has worked in almost all phases of nuclear energy from reactor design to development of new reactor concepts, and is presently General Manager of the Nuclear Technologies and Fuel Division of General Electric, responsible for the nuclear fuel cycle and the development of advanced nuclear reactor systems and technology. Dr. Wolfe is a Vice President of General Electric Company and a member of the Board of Directors of the Atomic Industrial Forum and the American Nuclear Energy Council. He is a Fellow of the American Nuclear Society, a Professional Engineer in the State of California, and a member of the National Academy of Engineering. He holds a half dozen patents in the nuclear field and is the author of several dozen publications concerning nuclear energy technology and nuclear energy and energy in general.

Congressman YOUNG. Thank you very much, Dr. Wolfe.

Our next panelist will be Mr. Jack Young, of International Energy Associates Ltd.

Mr. Young, please proceed.

STATEMENT OF JOHN C. YOUNG, PRESIDENT, INTERNATIONAL ENERGY ASSOCIATES LTD.

Mr. JOHN YOUNG. Thank you, Mr. Chairman. I am president of International Energy Associates Ltd. and we are the U.S. consultant to ASEA-ATOM of Vasteras, Sweden, for the PIUS Reactor Program. And today I would like to tell you what has occurred in that program since my testimony of last year and to make some brief comments on the DOE Civilian Reactor Program.

The view, the PIUS view, of the light water reactor as it exists today is that it is a quite safe reactor and it's a quite satisfactory reactor, and we think that the U.S. program should be very proud in that it is that light water reactor that is the workhorse and is the generally accepted option around the world.

At the same time, we see the need to enhance the lightwater reactor, and we see the programs that are going on by Westinghouse and General Electric. We think that that's a very sensible and encouraging direction. And we see that the industry would be preoccupied in enhancing the light water reactor. We think that's a very good course.

But in talking about the preoccupation, we think that also it should be administration policy and it should be the interest of the industry that there be options available for the future, that choices be made available for utilities. And that's going to take some special effort.

We think we heard yesterday from DOE that they have that character of interest, and we see that creating options, reactor options for the future, is the responsibility of DOE. But then we see that they run into a problem, and that problem is, if you're going to have serious options that go to commercialization, you need to have private money invested. And what we have in the Advanced Converter Program that DOE has had is that there is not a serious financial commitment in the private sector. And that makes it very hard to have a stable development program.

And I think there is a pretty good reason for that. I think American companies will not invest in projects where the return on investment is distant or where the market is pretty uncertain. And, you know, that's not too unreasonable an approach.

We do see the very credible and laudable investments in the lightwater program that are being made in Japan, and I think that that investment is being made because the people that are doing it see a return on investment in the projects that come out of the Japanese light water experience. It's near term, and they can deal in a market that has some certainty.

So the dilemma for the department is how do you work on developing options for the future on the one hand and have private investment coming in early on the other hand so there can be this serious, interesting commercialization. And that is what the PIUS reactor is about. It's being developed in Sweden using private sector money. ASEA-ATOM is a private company. They have made a significant investment over the years and have a lot to show for it. And we think that the concept of collaborative programs between countries is a way to match scarce resources and solve this problem of getting private investment to match with DOE.

I think there are people who are probably concerned about, "Well, why collaborate with a foreign company?" And the offer that I would make there is that in the concept that is being proposed by ASEA-ATOM, over two-thirds of the proposed DOE funding—which I will discuss—would be spent in U.S. labs and companies, and this then becomes what's called "technology transfer" to the United States. And I think it matches again what Mr. Vaughan was saying yesterday.

The outcome of that for the United States would be, in the case of PIUS, that PIUS could provide U.S. utilities an option in the 1990 period that would give them some freedom from regulatory constraints and would provide some inherent protection from the TMI-type financial concerns and would provide a competitive cost reactor in a smaller size.

And at the same time, there is a potential that PIUS could provide an ability for U.S. industry participants to participate in the Third World market. PIUS, there are a lot of words about "inherently safe" in PIUS, but also it is a very terrorist-resistant reactor, and those characteristics could be optimal for a Third World market if there is going to be one for the United States to penetrate.

Since my testimony last year, PIUS moved out in a number of important directions. In the technical sense, the design became modular. The entire steam generating system is now modular. It has, in concept, shop fabrication and complete shop assembly, and modular sizing now goes at the 200-, 400-, 600-, and 800-megawatt ranges, the smaller scale looking for the Third World market and the larger sizing looking to the industrial country market.

We have engaged with the NRC in a Licensing Review Program that's moving very well. And following the testimony last year, we met with the Tennessee Valley Authority and Oak Ridge National Lab as well as the U.S. contractors of ASEA-ATOM to structure a proposal by ASEA-ATOM for a joint and coordinated development program between ASEA-ATOM and the United States.

And then finally, we presented to the Department of Energy a formal proposal for such a joint and coordinated program. And I have submitted some brochures of a commercial nature on the PIUS reactor.

The PIUS strategy looks to prevent accidents rather than mitigate accidents. And I discussed them a good bit last year. I won't summarize them again. But the key concept is to limit the scope of review of the regulator, to protect the utility from a very broad scope of review. It would not go to the balance-of-plant, and it certainly would restrict the envelope of interest. And we find in our design review discussions with the NRC advanced reactor group, that we're doing all right, that we get the feeling that our prevention concepts versus mitigation are being understood and that we're working toward a fairly good progression.

Just a footnote on ASEA as a light water reactor supplier, because the issue is when you're developing an advanced reactor, have you earned your spurs in the business? ASEA is delivering this year two 1,050-megawatt electric plants, under construction.

They obtained a bonus payment from their clients if they could deliver the plants from pouring of pad to operation in under 5 years. They have achieved that. The cost, including financing, is under $1,500 per installed kilowatt. So they're able to do some things over there that we should wish to emulate here, I believe.

Their regulatory process is about the same in terms of a two-step structure, although I noticed last year, I think, Bert Wolfe said, "No, it's tougher here." Maybe it is. Maybe it is.

The history, though, of the ASEA experience is that their reactors have had a higher plant availability and higher reliability and a much lower occupational radiation exposure than many countries.

With respect to the advanced BWR design in Japan, it is ASEA that has licensed to General Electric and Hitachi and Toshiba many of the design concepts that are being incorporated. And these are concepts that have been in operation since 1978 in Sweden, so by the time it works its way back to the United States it will be in the 1990's. Now, that's what technology transfer is, though. And that's where PIUS is now another opportunity to get on board. You can get on board now or you can get on board 20 years from now.

A comment on our licensing program. As I say, we have submitted our licensing plan to the NRC and provided it to DOE. Our schedule would have a final design approval and rulemaking in 1992. We do not require a nuclear prototype. We have scheduled design review meetings that go through design criteria, codes, standards, comparison of PIUS against the generic LWR experience, looking at quality assurance, PIUS operations, and maintenance issues. Going along very nicely.

Last Friday we had a very substantive and good design review with the advanced reactor group at NRC, at the end of which they said, "Well, we cannot continue with the scheduled design review meetings that we have scheduled for the balance of 1985, calendar 1985, unless the Department of Energy incorporates the PIUS reactor as a DOE-supported program. And so that happened Friday, and at this hearing I would say, you know, the Department is going to have to make some decisions.

At NRC, the dilemma is, "Well, folks, ASEA has a significant investment going." We're making very good progress with NRC, who now says, "We can't go on like this anymore unless you become a part of a DOE Program." And we would urge the Department to make, you know, some kind of decisions in this area.

The Department is, however, with TVA, funding a joint assessment of PIUS, and we're appreciative of that. It's managed by TVA and involves funding of both entities. It's going to look at the design concept, at R&D needs and a number of things. And as an input to that, I note that EPRI conducted what we thought to be a very fine 2-day design review of PIUS in November. It involved the ASEA design team, our U.S. people, Babcock and Wilcox, MIT, the Royal Institute of Technology in Stockholm.

The EPRI comments, particularly those from MPR Associates, were very constructive and caused ASEA to discuss the design in very great detail, and comments have gone forward to both DOE and TVA for use in the current assessment project.

The balance of my testimony discusses the Development Program. There is a schedule. The element I guess I wish to impress is that we have in Sweden right now the proof-test test loop, the ATLE test loop. It is constructed, going into operation this summer. It operates at a very serious temperature and pressure. It is prepared to examine elements like two-phase flow.

It's a very good technical apparatus. And the proposal to the Department is that the Department join in on that test and that Oak Ridge and other department people contribute and participate, contribute their technical concepts and participate in the proof-test operations of the ATLE test loop.

In the meantime, PIUS's engineering design is continuing by ASEA-ATOM, and we have a specific proposal for fiscal 1986 in front of the Department that involves $6 million. That's described in my statement. More than $4 million of that would stay in the United States with U.S. labs and contractors; less than $2 million would go to ASEA.

I really think, in summarizing, that if we have scarce resources, which I think is the case, and looking, for example, at the good work that the Germans have done on the HTGR Program, where that success is becoming a factor here, I think PIUS is in the same kind of condition and there's an opportunity to take advantage of that. And that's what I ask you.

[The prepared statement of Mr. John Young follows:]

PREPARED STATEMENT OF
JOHN C. YOUNG
PRESIDENT
INTERNATIONAL ENERGY ASSOCIATES LIMITED (IEAL)

BEFORE THE

SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION
OF THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY

FEBRUARY 21, 1985

MADAM CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE

I am privileged to appear again before your Committee to comment upon the Civilian Reactor Development Program and Advanced Nuclear Systems.

International Energy Associates Limited (IEAL) is the U.S. consultant to ASEA-ATOM of Vasteras, Sweden for the development of the PIUS Reactor Program. My comments today will discuss the progress made in the PIUS program since last year's hearing and will briefly present observations on the DOE Civilian Reactor Development Program.

As a prologue to my comments on PIUS, let me indicate that I believe the present day light water reactor in the U.S. is safe and satisfactory and that programs to enhance the LWR design, including the standardized LWR, are a logical and important step in commercial reactor development. The U.S. can take great pride in the fact that the U.S.-originated light water reactors have been the preferred reactor of choice in most nations of the world and it has been the reliable workhorse of most nuclear power programs.

The U.S. LWR design improvements should move along at the same pace as regulatory reform. Clearly the U.S. utility industry should support the need for commercial LWR improvement programs. However, I believe there is general agreement that, in its preoccupation to enhance the present-day LWR, the U.S. should not avoid the responsibility for creating realistic and attractive options for future energy system choices.

I believe this perception is shared by the U.S. Administration in the sense that it favors the exploration of a number of interesting concepts in its advanced reactor program. In my remarks today I should like to emphasize why I believe the PIUS reactor is one such concept that holds great promise and that merits U.S. support.

Creating advanced reactor options for the future is a responsibility of the U.S. DOE, but it should be a shared financial responsibility with industry. Without that financial sharing, moves to commercial reality will be encumbered. There has not been a significant financial sharing by industry over the last several years in DOE advanced converter reactor projects, and consequently the projects have not proceeded on a steady course toward commercial development. U.S. suppliers are making considerable investments in LWR enhancement programs because they hope to recapture their investment in LWR sales, as in Japan. On the other hand, U.S. suppliers are not making sizable investments in the category, "advanced converter reactors." The reason is that U.S. industry is reluctant to invest in programs where their payoff is distant and the market uncertain.

The dilemma for DOE is how to develop advanced converter reactor options for future choices and at the same time have present-day, serious financial investment partners on the industry side. The PIUS Reactor is one example of a solution to that dilemma. ASEA-ATOM of Vasteras, Sweden has made the serious financial investment in the PIUS Reactor and continues its investment in the program. ASEA-ATOM has offered the PIUS technology to the U.S. in its proposal to the U.S. DOE to form a collaborative development program between ASEA-ATOM and DOE and contractors acting on behalf of DOE. ASEA-ATOM has proposed that over two-thirds of the proposed DOE funding for further exploration of the PIUS concept be spent by DOE laboratories and contractors in the U.S.

For those concerned with the merit of obtaining some industry investment in advanced converters, PIUS provides one instance in which there would be a proposed scheme involving a partnership between private investment and government support.

For those concerned about collaborating with a foreign company, I offer the following:

1. Over two-thirds of the proposed DOE funding would be spent in the U.S. in U.S. laboratories and companies.
2. A vital technology transfer to the U.S. would occur.
3. The proposed collaboration with Sweden would be compatible with the asserted emphasis the Administration says it wishes to now place on international collaboration in the field of reactor development, including the breeder. It would represent a fine example of two nations pooling their energies in support of common beneficial goals.

The benefits of U.S. participation in the PIUS program are seen as follows:

1. PIUS could provide an option for U.S. utility companies in the 1990s which features:
   - Increased freedom from regulatory constraints
   - Inherent protection against financial disasters due to TMI type accidents
   - Competitive costs in smaller unit sizes.

2. In time, PIUS also could provide an option for U.S. industry participation in third world markets since it is intended to be an inherently safe, terrorist resistant reactor with economic characteristics suitable for developing countries. The safety requirements placed upon the third world reactor operating organization would be reduced significantly for the PIUS reactor.

   As a matter of public policy I believe that in its advanced reactor program the U.S. should be open to all interesting ideas that might facilitate the orderly and safe use of nuclear power, regardless of whether they are conceived in the U.S. or elsewhere. It would be short-sighted in my view to close our eyes to interesting ideas that may have been conceived overseas and that are offered to the U.S. on attractive terms. The U.S. has taken this approach in the field of the HTGR where Germany has made notable advancements, and I believe it should adopt a comparable openness to creative foreign thinking in the case of PIUS.

Since my testimony last year before the Subcommittee, the PIUS program has moved in a number of important directions:

1. The PIUS design has been changed to have the entire steam generating system modular, with complete shop fabrication and shop assembly. With this modular arrangement, the PIUS sizing ranges from 200 MWe, 400 MWe, 600 MWe to 800 MWe. The smaller sizes are oriented toward the third world market. The larger sizes are directed at the industrialized country market.

2. The regulatory program with the U.S. Nuclear Regulatory Commission has proceeded expeditiously; and

3. ASEA-ATOM has held discussions with the Tennessee Valley Authority and the Oak Ridge National Laboratory, as well as with the ASEA-ATOM U.S.-based contractors, to structure a proposal by ASEA-ATOM for a joint and coordinated development program between ASEA-ATOM and the U.S.; and finally

4. ASEA-ATOM has presented its proposal to the U.S. Department of Energy for such a joint and coordinated development program.

As a supplement to this presentation I am attaching the ASEA-ATOM brochure on "PIUS Nuclear Power Plants."

With this background in place, I will now discuss the PIUS Reactor Program and the ASEA-ATOM proposal to DOE.

PIUS is the third in a series of ASEA-ATOM SECURE Reactor designs:

(1) SECURE LH - District Heating Reactor (240° F)

(2) SECURE H - District and Process Heating Reactor (370° F)

(3) SECURE P - PIUS Power Reactor (560° F)

PIUS strategy is based on the view that the present LWR approach should be simplified and is subject to excessive regulatory constraints. The PIUS concept is aimed at reducing dependence upon safety devices and human judgement in crisis events. The key elements of the PIUS strategy are:

(1) Maintain the basic LWR technology, including the fuel cycle, but eliminate the current degree of high dependence on engineered safety systems and human judgement.

(2) Limit the scope of safety grade equipment.

(3) Eliminate the potential for severe accidents.

(4) Minimize the potential for regulatory backfit.

(5) Guarantee reactor core integrity under all credible circumstances through the passive action of the laws of thermohydraulics and through enclosure of the primary system in a massive concrete structure.

(6) Protect owner's investment against TMI type accidents.

The strategic results are:

(1) The balance of the plant becomes unessential to public safety and is freed from regulatory restraint.

(2) The reactor plant design is simplified.

(3) An improved regulatory environment and public acceptance.

The resulting economics, in comparison with the traditional LWR built to date are:

(1) The entire steam generating system is modular and is shop fabricated and shop assembled.

(2) Reactor plant piping systems are reduced significantly.

(3) Instrument and control systems are reduced.

(4) The number of safety related components are reduced, reducing Quality Assurance requirements.

(5) Reactor coolant recirculation becomes a low pressure system.

(6) The residual heat removal and emergency core cooling systems are simplified.

(7) Operating costs are reduced through

- Less operations staff
- Less security staff (PIUS is saboteur and terrorist resistant)
- Reduced In-Service Inspection.

(8) A reduction of regulatory restraints is achieved through

- Less safety systems
- Less vulnerability to backfits
- Easing of site selection criteria
- Need for less Quality Assurance.

(9) The above benefits far outweigh the two PIUS cost penalties:

- Lower thermal efficiency
- Increased cost for concrete pressure vessel.

ASEA-ATOM performed a cost comparison between PIUS at 600 MWe, two standard sizes of ASEA BWRs (1000 MWe and 700 MWe), and a 600 MWe coal-fired plant with Flue Gas Desulfurization. The results indicated that at 600 MWe PIUS is significantly cheaper than coal and the conventional LWR.

The cost comparison with the ASEA BWR is worthy of note. ASEA-ATOM will deliver two 1050 MWe BWR plants this year at an installed cost under $1500/kWe, including the financing cost. ASEA-ATOM light water reactors have consistently out performed those in several other countries through:

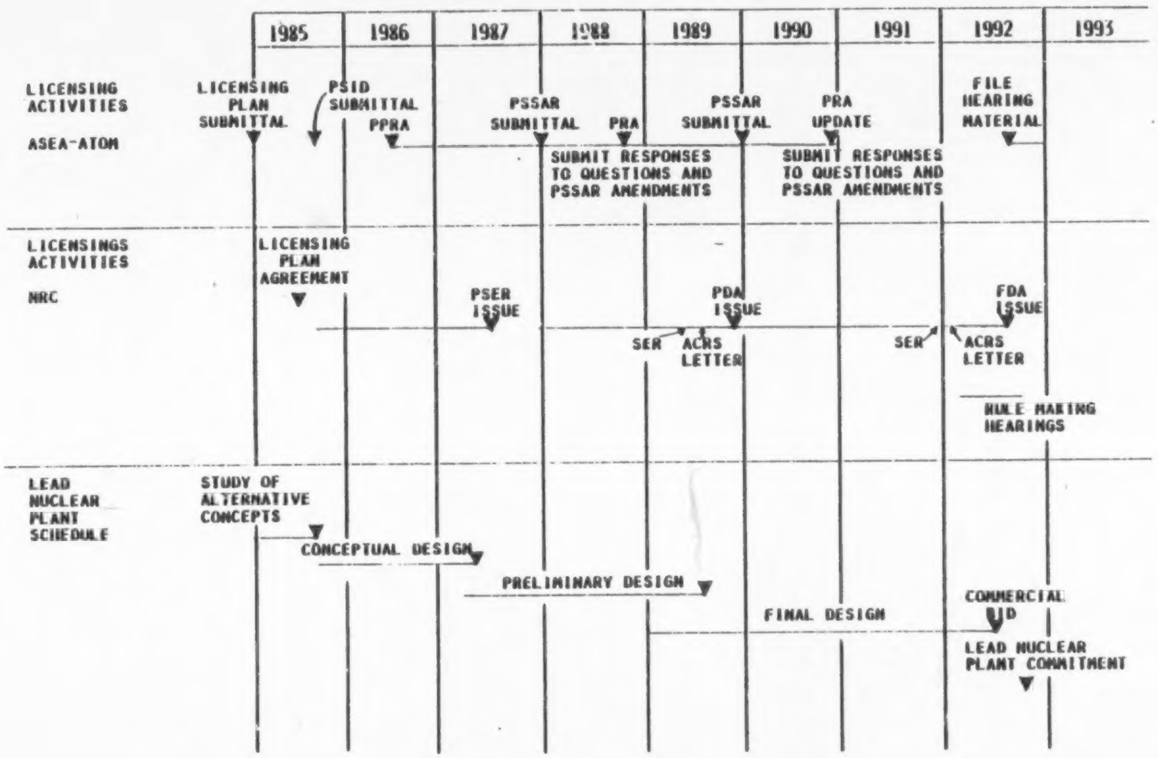
- Higher plant availability and reliability.
- Lower occupational radiation exposure, by an order of magnitude.
- Five year construction program, using a two-step licensing procedure as in the U.S.

Also, the present-day ASEA-ATOM BWR design features -- for the second generation ASEA-ATOM plants which have been in commercial operation since 1978 -- have been licensed by ASEA-ATOM to General Electric, Hitachi and Toshiba for incorporation in the Japanese ABWR. Perhaps some day in the 1990s the ASEA-ATOM BWR design principles of the 1970s will be operating in the U.S. through technology transfer from ASEA-ATOM.

PIUS Reactor Licensing Program

ASEA-ATOM initiated formal interactions with the NRC in 1983 and commenced review meetings with the NRC staff in 1984. The Draft PIUS Licensing Plan has been submitted to the NRC and provided to DOE. The proposed date for the NRC Final Design Approval is in 1992, four years ahead of the DOE HTGR program. A copy of the PIUS Licensing Plan Schedule is on the following page. The PIUS design review meetings are ongoing with the newly created NRC Advanced Reactor Group. The agenda for the 1985 meetings includes the following:

PIUS LICENSING PLAN SCHEDULE


1985
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LICENSING ACTIVITIES
ASEA-ATOM
LICENSING PLAN SUBMITTAL
PSID SUBMITTAL
PPRA
PSSAR SUBMITTAL
PRA
PSSAR SUBMITTAL
PRA UPDATE
FILE HEARING MATERIAL
SUBMIT RESPONSES TO QUESTIONS AND PSSAR AMENDMENTS
SUBMIT RESPONSES TO QUESTIONS AND PSSAR AMENDMENTS
LICENSINGS ACTIVITIES
NRC
LICENSING PLAN AGREEMENT
PSER ISSUE
PDA ISSUE
SER
ACRS LETTER
FDA ISSUE
SER
ACRS LETTER
RULE MAKING HEARINGS
LEAD NUCLEAR PLANT SCHEDULE
STUDY OF ALTERNATIVE CONCEPTS
CONCEPTUAL DESIGN
PRELIMINARY DESIGN
FINAL DESIGN
COMMERCIAL BID
LEAD NUCLEAR PLANT COMMITMENT

- Discussion of General Design Criteria
- Design Basis Events
- Regulatory Guides
- ANSI and other Standards and Codes
- Environmental Qualifications
- Quality Assurance/Quality Control for the concrete vessel
- PIUS operations and maintenance
- Review of PIUS in light of LWR first generation Generic Safety Problems.

The ASEA-ATOM presentations to the NRC staff conform to the present way the staff performs its design reviews; however, the PIUS design strategies match the evolving NRC policy on advanced reactor licensing. In fact, the NRC advanced reactor licensing policy is modeled to a great extent from the PIUS presentations made to the NRC Commissioners and Advisory Committee on Reactor Safeguards in 1983.

There is a key issue which has arisen between DOE and NRC on the PIUS licensing program. In the review meeting held between ASEA-ATOM and the NRC Advanced Reactor Group on February 15, 1985, the NRC staff advised ASEA-ATOM that the follow-on design review meetings planned for the balance of calendar year 1985 could not be scheduled unless DOE incorporates the PIUS Reactor as a DOE supported program.

Joint TVA-DOE PIUS Assessment Project

The Tennessee Valley Authority and DOE are jointly funding an assessment of the PIUS Reactor. The project is just underway, will be managed by TVA, and will include independent contractors. The assessment scope includes:

- Design Concept
- R&D needs
- Safety issues
- Capital and operating costs
- Staffing requirements
- Operability
- Schedules for design and construction

The Electric Power Research Institute (EPRI) conducted a two-day PIUS design review meeting with ASEA-ATOM and its contractors Babcock & Wilcox; MIT; and the Royal Institute of Technology, Stockholm. The EPRI design review comments, particularly those of its contractor MPR Associates, were most constructive and enabled ASEA-ATOM to discuss the PIUS design in much greater detail. ASEA-ATOM has responded to the MPR Associates' comments and provided copies to DOE and TVA for use in the current PIUS Assessment Project.

PIUS Development Program

ASEA has made a significant investment in the PIUS program. The key products of this investment are:

(1) The ATLE test loop in Sweden, specially built for test proofing PIUS.

(2) The PIUS reactor conceptual design and analysis, including the products of ASEA-ATOM and its contractors, B&W, MIT and the Royal Institute of Technology.

(3) The continuing plant engineering and design by ASEA-ATOM.

There are four major areas of R&D:

(1) Thermohydraulic R&D

- Basic Demonstration of the Hot/Cold Interface has been completed by the TVA Norris Engineering Laboratory.
- Studies are ongoing at ASEA-ATOM, MIT and the Royal Institute of Technology (Stockholm).
- Wet thermal insulation development concept established by a previous program, but more testing is needed.
- Major test loop (ATLE) under construction in ASEA-ATOM facilities. Scheduled for mid-1985 startup.

(2) Once-Through-Steam-Generator (OTSG)

Under contract to ASEA-ATOM, Babcock & Wilcox has confirmed ASEA-ATOM's design approach and has proposed a development program.

(3) The Reactor Core, Prestressed Concrete Pressure Vessel (PCPV) and Recirculation Pumps are not considered to be development areas, although an R&D program has been recommended for the Concrete Vessel to satisfy U.S. requirements and interests.

(4) Operations and Maintenance must be examined with special attention to:

- In-Service Inspection
- Fuel Handling
- Component Maintenance and Replacement

ASEA-ATOM met with TVA and ORNL in 1984 to discuss PIUS Reactor development requirements in the context of a joint and coordinated program between ASEA-ATOM and the U.S. ASEA-ATOM has recommended to DOE the following general approach:

(1) DOE and ORNL should participate in the ASEA-ATOM ATLE test loop demonstration starting in the second half of 1985.

another aspect of the expansion of our national effort to control air toxics. Under the state/local initiative, EPA will take a number of strong steps to promote appropriate analysis of action required to address localized problems that may be caused by pollutants or sources.

Multi-Media Methods to Control Toxic Pollutants. EPA will expand its current studies of local toxics problems and will work more closely with States and localities on how best to consider multi-media/multi-source interactions in controlling areas of localized risk. EPA will apply lessons from geographic investigations and personal monitoring studies to develop procedures for integrated environmental management.

Sudden, Accidental Releases: Programs in Place

With regard to accidental releases, there is an informal but workable division of activity in effect between the private and public sectors. Much of the capability in place to prevent accidents is the product of corporate self-interest. Additionally, while some Federal controls tend to promote accident prevention, the role of government centers on technical information sharing, guidance, and emergency preparedness and response.

One of the most important Federal authorities for emergency preparedness and response is the reportable quantities provision under the Comprehensive Environmental Response, Compensation, and Liability Act (Superfund). This set of rules, which requires a release of specified amounts of identified substances to be reported by the responsible party, promotes safe chemical handling and provides EPA and States with needed information in the event of a release, either to initiate emergency response, or to identify needs for further emergency preparedness. Other important tools are the authorities of TSCA, which require record-keeping and reporting of certain chemical-related hazards that might be observed. Statutes administered by the Occupational Safety and Health Administration and the Department of Transportation are directly related to accident prevention, and like those of DOT's Coast Guard, provide important authorities for emergency preparedness and response as well. As for States and localities, they are almost always the first to respond to a spill or release.

Also in place is the National and Regional Response Team mechanism. The National Response Team (NRT), which EPA chairs with the Coast Guard as vice-chair, includes among its membership representatives from every Federal agency having significant hazardous substance emergency preparedness and response authorities and responsibilities; its Regional component, the Regional Response Teams includes the same Federal agencies plus representation from State and local governments as well. A preparedness committee has been established and a national assessment of state/local emergency preparedness capability is currently being conducted. The National Contingency Plan, originally designed in the 1960's around oil spill issues, was thoroughly revised after Superfund was passed in 1980 and has just undergone a major revision which strengthens it in the essential areas of coordination, planning and response.

Sudden, Accidental Release: Needed Actions

There is much concern and activity underway within the chemical industry itself to evaluate and upgrade its safety systems. While this is appropriate, EPA believes that it must at the same time reinforce systems in place for emergency preparedness and response.

EPA is taking a number of steps to enhance State and local capability for emergency preparedness and response. By adding to its Regional staff and establishing a headquarters staff to specifically focus on these efforts, EPA will be able to offer a number of needed services to States and localities in the area of contingency planning, technical assistance, training, and response. EPA is taking strong steps to coordinate and improve national policy and planning for emergency preparedness and response through the National Response Team and the National Contingency Plan. The Environmental Response Team is increasing its training efforts targeted for State and local authorities and adding staff to increase its capability of providing technical assistance to States and local governments in response as well as in planning and preparedness.

The Agency is also taking three major actions to reinforce existing programs or add new activities. First, EPA will revise operating guidance, increase resources, and provide expanded staff training to enforce reportable quantity requirements, as well as recordkeeping and reporting under TSCA. These actions will provide the data to assure a prompt response to emergencies and will also achieve a higher level of comprehensive reporting on spills and releases upon which to base contingency planning. Where reports indicate a pattern of chemical mishandling, EPA will join with other agencies and States to inspect facilities or situations where chemical practices may be unsafe. The Administration has also requested that additional civil enforcement authorities be incorporated into the CERCLA statute to provide increased opportunity for enforcement action on reportable quanity violations.

Second, EPA will advance efforts to develop a Community Right To-Know program. While the specific structure and details of this program are still being developed, we believe that such a tool will prove to be an important basis for realistic, focused contingency planning at the local level and also assure that the local citizens have the data necessary to make conscious and informed choices.

Third, EPA will prepare and issue an Acute-Hazards List. This list will include chemicals which, if involved in an accidental release, would be most likely to result in serious harm to those exposed. It will identify substances that are likely to cause either acute or chronic serious health effects from a short-term, high level exposure, and which have characteristics such as volatility and ignitibility which add to the potential for increased human exposure in the event of an uncontained release.

We decided that a new list was required after our review revealed that no existing lists are quite on target. Some lists were either too broad in that they did not address the potential for rapid dispersion of a chemical, such as its volatility or others were too narrow in that they did not include all chemicals of potential concern in accident situations, such as process intermediates.

The list will be used in several ways. First, it will be provided to the States and local governments along with guidance to assist in the development of focused follow-up actions, such as inspections, audit programs, community awareness programs or increased preparedness and response efforts, which are best undertaken at the local level.

Second, EPA will use the list to target federal emergency response and preparedness efforts. Thus, our efforts to increase technical assistance to States and local communities in the areas of contingency planning, training and response will be focused on those areas where the listed acute hazard chemicals are handled - stored, processed, formulated or manufactured. It will also allow site-specific contingency planning to be accomplished locally, with Federal technical assistance and guidance, in dealing with the specific requirements and characteristics of the community.

Finally, we believe that the chemicals identified in the acute hazards list should provide the focus for Community Right-to-Know programs. I believe that, without such a focus, local communities will not be equipped with the necessary information to make priority-setting decisions. Without such federal guidance, these communities may be faced with either so little information as to make effective action difficult, or so much information as to overwhelm the ability of the community to evaluate and act on it. Providing a targeted focused list of chemicals should greatly aid communities in determining how best to address their specific potential problems.

In conducting our far-ranging review of existing and emerging programs, we noted several significant principles at work. These principles characterize the Agency's approach to environmental protection after fifteen years of experience, and are reflected in the Agencies strategy to deal with airborne pollutants. They are:

- The need for priorities. We cannot do everything at once, so we must target our efforts where we can get the greatest environmental improvement soonest.

- The need to account for cross-media transfer. We cannot clean the environment by pushing pollutants from one medium to another. We must consider the effects on all media, even as we concentrate on one.

- The need to use the right tools. We cannot protect the environment by rote. We must exercise ingenuity in developing new ways to apply existing authorities or combinations of authorities in order to get things done as effectively and efficiently as possible.

- The need to involve States appropriately. States have a better grasp on locally significant problems than can any national Agency. We need to organize work so that each level of government makes its unique contribution.

- The need to protect against immediate hazards. Long-term risk from cancer is a natural focus of a public health agency, but immediate hazards from sudden releases of chemicals that, by the nature of the release, present other serious health effects deserve vigorous attention as well.

EPA solicits the support of the American public, State and local governments, industry, and the Congress as we work to deal effectively with the air-toxics problem. By doing so we can all fulfill our demonstrated national commitment to protect public health and the environment for all Americans.

Mr. Chairman, in your letter of invitation you asked me to provide the views of the Agency on H.R. 2576, the Toxic Release Control Act of 1985. While the Agency's assessment of the bill is preliminary, I believe it is revealing. I would like to state at the outset that we both share the view that air toxics pose a serious and difficult problem which must be addressed. Where we disagree is in our assessment of the scope of the problem and the magnitude of the program needed to address it.

The two main concerns we have regarding the effects of this bill are that it would impose huge costs on society for limited environmental gains and that it could result in serious environmental opportunity costs. I am afraid that while the pollution control community is spending its time and resources on implementing the vast requirements of H.R. 2576, other real and in some cases severe environmental problems would receive inadequate attention.

The range of sources and pollutants likely to be covered by the bill is enormous. An initial list of 85 substances is designated as hazardous. Some are carcinogens but not particularly potent, some are acutely hazardous, some are volatile, some are not. The same broad-brush remedial measures are assigned to all of them. In addition, within a year of enactment, another group of 300-400 substances must be added to the designated list. Covered under the proposed legislation is anyone who manufactures, processes, stores, or releases more than one metric ton in any month of a designated substance into the air. Someone burning more than ten metric tons in any month is covered also. Let me cite a few examples of the kind of sources that we believe would be affected:

- 200,000 public gasoline outlets and perhaps another 200,000 privately owned gasoline tanks owned by taxicab companies, rental car companies, municipalities, etc.
- 165,000 industrial boilers and possibly over one million space heating units, e.g. furnaces or boilers in medium-sized buildings (over 15,000 square feet) that burn fuel for space heating -- a 20-unit apartment building, a small office building, or a medium-size department store.
- 15,000 dry cleaners.
- 50,000 vapor degreasers that use solvents (most metal fabrication and other diverse cleaning operations).
- Diesel engine production (cars, trucks, buses, farm equipment) could be affected severely.
- About 175,000 commercial pesticide applicators involved primarily in agricultural applications appear to be subject to the bill. Almost one million private certified applicators, mostly farmers, also may be subject. Cotton and orchard crops would be especially affected because they require frequent and high application rates.

- Wastewater treatment facilities would be affected.
  - 15,500 municipal and 20,500 industrial treatment plants could be covered; coverage could be expanded to include all pump stations, storm water treatment facilities, vented manholes, and even on-site septic systems.
- About 7000 municipal wastewater treatment facilities use chlorine as a disinfectant. Another 8000 municipal wastewater treatment facilities use aeration in large open tanks or lagoons as the main secondary treatment process; these would also be covered.

I have just cited an incomplete list of sources likely to be affected. Once an owner or operator comes under the purview of the bill, he must meet a long list of requirements:

- He must get a permit to operate, build, or modify an emissions unit.
- He must file a statement describing that year's emissions of each designated substance from each emissions unit.
- He must install or use the "best available leak control devices."
- He must label any pipe, storage tank, or container used to store, manufacture, or process a designated substance if there is a reasonable likelihood of a release threatening health or the environment;

- He must install and use the most stringent controls achievable. The level must be set based on maximum technological feasibility. If the standards of control are not determined by EPA within the time specified, the standard for that category must be no "detectable release."
- He must monitor releases from the source, if necessary, to insure that he is meeting the permit requirements. Owners of "large sources" must also monitor ambient air in the affected community to mesure the level of the substance.

I would now like to turn my attention to the emergency response and right-to-know sections of this legislation. Clearly, these are areas of major concern to us all, and to the extent these proposals lead to a higher level of preparedness and awareness, developed and paid for by industry and accomplished by the State and local governments and its citizens, we are in agreement. Where we are not in accord is on the methods of getting there. These proposed provisions require that response plans be prepared by local industry in coordination with the local community. They also require enforcement by the Federal government. Further, if the States do not take action to establish the Emergency Response Districts, the EPA Administrator must designate the District, and assume the responsibilities of the emergency response committee within each of these districts. These would include the obligation for review and the development of these plans, communicating their content to the public, exercising the plans and inspecting the facilities. These site specific actions are clearly the responsibility of the local community and not a duty the Federal Government should assume. It is the local community which must understand the issues and be prepared to meet any contingency since it would be the first to respond and the most affected by such an emergency. These observations are quite apart from the enormous Federal resources such a program would require. We perceive the more appropriate Federal role as one of providing guidance, technical assistance and training for development of these plans. In any event, I believe the details of the emergency response plan ingredients are better left to policy development by the Agency through the National Contingency Plan rather than legislation.

On the matter of Community Right-To-Know, I surely share the view of this legislation that citizens are entitled to a great deal of information about the potential threats in their community. To that extent, I support a program which would result in the sharing of data by industry. Again, it is a matter of degree. This bill would require enormous amounts of data to be made available to virtually everyone regarding virtually all chemicals in the community. This could result in a tremendous amount of information which, by its sheer mass, could overwhelm the local communities' capability to manage it. It also establishes a significant role for the Federal government in the receipt and maintenance of the information. I suggest that EPA focus more specifically on those chemicals identified on the acute hazards list, and assist the community in developing programs around the sharing of that data and its uses for preparing contingency plans, identifying proper protection procedures, and advising the local emergency and medical authorities of the characteristics of the chemicals and the proper treatment of any citizens who may become injured. After this initial effort, when the community will have become organized to deal with the data, and will have developed priority programs to protect against the most acutely hazardous chemicals, it could then expand its efforts to include other items of local interest as well.

In conclusion, while I believe your concern and intent is well-placed, I fear that enactment of this proposal would have serious adverse impacts on many parts of our society while important environmental gains may be sacrificed. In sum, our assessment of H.R. 2576 is that its implementation would be impossible and its objectives unattainable. I hope that we can work together as the Agency learns more about the nature of toxic air pollutants and moves to address the problems we face. I do believe that the strategy I have described today is a thoughtful and aggressive move in the right direction. I will be happy to take your questions.

Mr. WAXMAN. Thank you very much, Mr. Thomas.

We have a number of problems to deal with. We have sources of pollution and as a result from some of these sources there is a threat to the public health, there's no doubt about it. We want to deal with the question of the extent, and the question of priorities.

The Environmental Protection Agency is designing a whole new Federal strategy. The strategy appears to say what's more important than the toxic pollutants that may be coming from the chemical plants is the fact that we have wood stoves, dry cleaners and gas stations, and that that is the real danger that the Federal Government should emphasize in trying to control these pollutants.

I don't want to dismiss that, because I want us to do all that we can do, but I question the priorities.

Now this morning we had another side issue come in, with an article in the New York Times, where we were told the real problem that's the most serious perhaps is indoor air pollution.

Now I want us, in the short time we have, to evaluate some of these premises upon which we are making these conclusions.

First of all, when we look at the indoor air pollution problem, the question has to be what is EPA doing about that?

First of all, I want to know whether you think a toxic air pollutant problem is more serious indoors than out, and if it is a serious problem, whether it's more serious or not, how is the agency dealing with it, particularly when we look at the budget for the agency to deal with indoor air pollution research going down by over $340,000 next year.

I want to know if you think that budget is adequate or if you are seeking an additional amount, when according to the agency's own figures there are more than 20,000 cancer deaths a year from indoor exposures to radon. When will the agency adopt standards to protect the public health from this particular problem?

So let me just touch upon that.

Then I want to move on. I want to just touch on this very briefly. Do you consider this a more serious problem, indoor air pollution, than the others, and are you addressing it adequately?

Mr. THOMAS. Mr. Chairman, let me address that issue. Let me also address the issue you started off with, which is the point versus area sources.

Mr. WAXMAN. Please don't, because we're going to get to some questions on that. Please address this one and let me get to some questions on that.

Mr. THOMAS. They are directly related. I think both indoor air, outdoor air point and area sources are all a part of a larger problem we need to deal with.

Mr. WAXMAN. Absolutely.

Mr. THOMAS. I fully intend for our agency to deal with both components of that problem. Point area, indoor and outdoor problems.

Mr. WAXMAN. The question is, What emphasis do you think the toxic air pollutant problem is more serious indoors than outdoors?

Mr. THOMAS. The study that you referenced, the article in the New York Times references a study which we did. We may want to ask Dr. Goldstein, who is here with me, to comment on it, but it was a study that indicates a serious concern about indoor air pollution, and I don't say that it is an either-or situation, indoor or outdoor being the problem. I think it indicates to us that we need to take into account possibly far more than we ever have in the past problems associated with indoor pollution as we try to address environmental controls of toxic air.

Mr. WAXMAN. No; one is saying either of these choices are either-or. The question is where we put our resources and whether we are doing our job adequately, if that problem is a serious one. If indoor air pollution is the most serious, as that article indicated, based on a report from over a year ago, then we ought to be devoting more resources to it than appears to be the case, and we ought to be setting standards for something like radon. If it is not as serious in terms of priorities, then the gas stations, dry cleaners, wood stoves, that ought to be our highest priority.

Evidently, as I understand your strategy, those area sources—those sources such as gas filling stations and dry cleaners and wood stoves—is the highest priority. Is that an accurate statement?

Mr. THOMAS. No, we have both sources, we're dealing with point sources and the area sources, and the strategy lays out how we deal with both.

Mr. WAXMAN. Answer the question yes or no. Is indoor air pollution the most serious problem we have in terms of exposure to chemicals from the air?

Mr. THOMAS. It is not a yes-no question.

Mr. WAXMAN. OK. So you wouldn't conclude, then, as the article concluded, that this is a more serious problem?

Mr. THOMAS. I conclude that it's a serious problem, and we need to do extensive research on how serious it is and how to deal with it.

Mr. WAXMAN. Let's look at your national strategy, which you believe will reduce the health risks from air toxics. It is based on this 35-county study and the 6-month study. In fact, I think there were four stratagems based on four different studies: ambient air quality study, ambient epidemiology study, NESHAP study, and 35-county study, which employed modeling.

Now in that report itself there was a statement to the effect—in fact, a disclaimer. The report said risk—I am quoting from it—risk estimates presented in this report should be regarded as only rough approximations of total incidents and individual risks. That should be used in a relative sense only. Estimates for individual compounds are highly uncertain. They should be used with extreme caution. Despite the fact that quantitative estimates of risk are presented in this report, this study was not initiated to support specific regulatory provisions.

Notwithstanding that disclaimer, you decided to base your regulatory strategy on this 35-county study. Did this study cover all toxic effects from air toxics, such as gene damage, birth defects, acute and chronic lung and kidney disease and brain damage?

Mr. THOMAS. No. The study concentrated on cancer effects because that's the effects we can characterize and develop risk estimates for.

Mr. WAXMAN. Did the study cover all the organic chemicals released from chemical plants?

Mr. THOMAS. The study covered those primary organic chemicals that we know about, what we would call the bad actors that we can characterize and deal with.

Mr. WAXMAN. So it covered, as I understand it, 21 selected compounds as compared to the thousands of organic chemicals released from chemical plants. The 21 compounds, by the way, is only 5 percent of the organic chemicals listed under EPA's Emission Data System, which is admittedly incomplete. Of the 21 selected chemicals, did the study cover all the releases of the chemicals into the air?

In other words, did you look at fugitive releases of these 21 compounds?

Mr. THOMAS. In some components of a study we did, for instance, the NESHAP study took into account——

Mr. WAXMAN. I'm talking about the 35-county study. Did you look at fugitive emissions?

Mr. THOMAS. Yes, we did.

Mr. WAXMAN. Who is this gentleman, sir?

Mr. THOMAS. Mr. Stekerwald and Ms. Thomson, who were the two co-authors of this study, sitting behind me, and they are shaking their head up and down.

Mr. WAXMAN. So you looked at the fugitive releases. Did you look at routine accidental releases?

Mr. THOMAS. I'm sorry, I didn't hear you.

Mr. WAXMAN. The routine accidental releases, start-up, shutdown, the kinds of things——

Mr. THOMAS. No, we didn't.

polar crane and the key milestone step of the removal of the reactor vessel head in order to gain access to the fuel. The head was removed on July 24 of this year. Recently the reactor vessel upper plenum above the core was jacked free of any constriction to ensure its readiness to be removed in May.

To expedite the cleanup and put the program back on its schedule before the delays associated with the polar crane controversy, GPU put forward in March, 1984, an additional $10M of funding for 1984 activities. The DOE responded with an additional $5M in 1984 funding. This came at about the time the Japanese agreed to provide $3M per year plus 11 professionals to the TMI-2 effort. This addition of $18M assured that funding was not limiting progress of the work.

The Project was given a goal of the earliest practicable start of fuel removal, with auxiliary goals of determining the location and planning for the removal of fuel in the reactor coolant systems outside the original core volume. It was given an additional goal of organizing and commencing a determined further effort to lower the general radiation levels throughout the plant.

As a result of these efforts to accelerate the project, we expect to begin removal of damaged fuel in July, 1985. At present, the primary coolant system is at atmospheric pressure, at less than 100 degrees F and self-cooling; that is, no artificial circulation is required since the decay heat is only 15 kW. The boron content of the coolant water has been increased to more than 5000 ppm from approximately 3700 ppm which kept the core safely subcritical during the first five years after the accident. This level was chosen to absolutely assure subcriticality during defueling.

With the system at low temperature and atmospheric pressure, the potential for consequential release of activity has been greatly reduced.

After considering the present conditions at the TMI-2 reactor the Safety Advisory Board, chaired by Dr. James Fletcher, stated in its May 1984 Annual Report:

> "The members of the SAB are unanimous in their opinion that TMI-2 does not currently pose a significant risk to public or worker health and safety."

The Safety Advisory Board also concluded as a result of a specific question raised by GPU Nuclear that "because the radioactivity levels are so low and the heat source so small, no accident involving the release of radioactivity was found that could prevent the safe shutdown of TMI-1."

In recognition of the great differences between the physical circumstances in the TMI-2 reactor now and those in an operating power reactor, we have prepared an extensive justification for fundamental changes in the Technical Specifications for TMI-2, which, in the main, still relate to an operating power reactor. We expect NRC action on our request for these changes in the near future.

After defueling in Phase II, we will proceed with Phase III, which entails additional decontamination work to achieve plant conditions which would eliminate, for all practical purposes, hazards to the public from radiation and radioactivity releases.

We are currently working to the following criteria for completion of

Phase III:

- Bulk fuel canned and shipped off-site.
- Fluid systems flushed and drained.
- Surface contamination removed or fixed.
- In plant radiation areas secured and isolated.
- Non-commercially disposable waste shipped to DOE facilities.
- Processed water disposed of.

We believe that meeting such criteria will assure stable and secure conditions and provide full protection of the public and the environment.

The milestone schedule for the remainder of the project is:

- Remove the reactor vessel plenum	May 1985.
- Commence removing fueld from the reactor vessel	July 1985.
- Commence shipping fuel to INEL	April 1985.
- Complete fuel removal from core region	July 1986.
- Final cleanup	July 1988.

We will be continuing dose reduction work in 1985, with emphasis on completion of floor scabbling, along with additional shielding and decontamination tasks. These are focused on further dose reductions in those in-containment locations which will have high occupancy during defueling. Also planned in 1985 are dose reduction tasks which will support later removal of fuel from locations outside the reactor vessel, and characterization and initial decontamination of the containment building basement.

For defueling, a shielded rotating platform will be installed over the open reactor vessel. Crews stationed on this platform will operate tools and equipment to put the damaged fuel in canisters which will then be sealed. The canisters will be 14 inches in diameter and about 12-1/2 feet tall. They will be handled and transferred through the fuel handling mechanisms roughly the same as a fuel element. Two basic techniques will be used to pick up the fuel:

1) By using the long handled manual tools and in some cases a robotic arm, large pieces of fuel will be picked up and placed in canisters, and

2) We will also use a vacuum system to pick up small pieces.

In both cases, underwater TV cameras will be used as primary method of guiding the pick-up tools.

In addition, special tools will be provided to permit separation and extraction of fuel from lower portions of the core, the physical condition of which is not yet known.

After fuel removal from the core region is completed, some partial disassembly of the core support assembly will be performed. This will permit access with the vacuum system into the outboard and lower sections of the core support assembly and the lower reactor vessel head for removal of fuel particles accumulated in those locations.

We expect to fill about 250 fuel canisters in the defueling process. A contract between GPU Nuclear and the Department of Energy is in place for shipping these fuel canisters to the DOE Idaho Site and storing them there.

DOE will take possession of the canisters at the TMI-2 site and ship them via rail transport casks now being procured by the DOE.

One aspect of the TMI-2 project which seems to me to have been underestimated by some, is the great research and development value of the cleanup. TMI-2 is in reality a giant laboratory. Prior to the accident, much had been theorized and many assumptions made about the performance of a reactor and its fuel during an accident, especially about the release of fission products, but there was little experimental evidence with which to check the assumptions. TMI-2, unfortunately, gave an opportunity to test those assumptions in a massive way. Studies during the last five years based on TMI-2 observations, confirmed by additional laboratory work, have provided the basis for reconsideration of accident safety assumptions. Indications are that, depending on the isotope, radioactive releases from a severe accident are from 10 to 1000 times less than previously assumed. We are systematically removing samples from the core to assist in these studies. Eventually, the entire core will be shipped to INEL for detailed examination to establish the accident sequence and fuel and fission product behavior.

This is only the first and most significant of the technical lessons to be learned. There are many others, including:

a) Methods of decontamination of many kinds of surfaces and several contamination types.

b) Design of systems for removing radioactivity from liquids.

c) Equipment and procedures for avoiding heat stress while working in protective clothing.

d) Removal, canning and shipment of badly damaged reactor fuel.

e) Use of robots and other remote equipment to work in areas men cannot enter.

f) Techniques and equipment for detecting and quantifying fuel in systems and components outside the reactor vessel.

g) Effects of an accident on all types of safety equipment and the resulting environment.

h) Plant construction methods and details that would have made the cleanup and recovery operations easier, faster and less costly.

Much has been achieved and a great deal of information extracted from the analysis of the accident and in the preparation and conduct of the recovery operations. There is a great deal more to be learned during the remainder of the Project. We are working closely with Department of Energy, Electric Power Research Institute and Edison Electric Institute to assure the maximum is learned and made available to all interested parties.

The DOE, and its principal agent EG&G Idaho, and the special NRC Project organization for TMI-2 have been working constructively with us within their spheres of responsibility to conclude this difficult task. In particular, the DOE's funding of R&D at TMI-2 has been most helpful in carrying out the project effectively.

A major milestone of the TMI-2 project was reached last month when the first contribution from investor owned utilities throughout the United States was received. This contribution was the first of a commitment worked out under the auspices of the Edison Electric Institute to provide $150 million in six annual installments of $25 million. With initiation of this EEI program, funding plans for the cleanup program are essentially complete. A summary of the funding sources is:

Insurance	$306
GPU Customers	247
GPU	95
States of Pennsylvania and New Jersey	41
Department of Energy	83
U.S. Nuclear Utilities (EEI and EPRI)	152
Japanese Nuclear Industry	18
GPU Advances	45
	$987 Million

This funding plan assumes a total of $33M of DOE funding to support R&D at the site in Fiscal Years 1986 and 1987. We can proceed in 1985 with the cleanup as rapidly as prudence permits not limited by funding. We expect that situation to prevail through the cleanup.

At the end of 1984, we had expended almost exactly one half of the total of $1 billion estimated to be required to clean up TMI-2.

With that expenditure, we have removed the threat of the highly contaminated spilled water, greatly reduced general contamination levels throughout the plant, determined the general condition of the reactor core and primary system, removed the reactor vessel head and are well along with the design, development and manufacture of the defueling system.

We believe we have a sound organization and a sound technical program and we have reached a point at which funding is not now a constraint on an aggressive, deliberate schedule and program plan.

You have been provided a set of several recent photographs of TMI-2. Figure A shows a cross-section of the reactor vessel and some of the debris samples already taken and under laboratory evaluation. Figure B and C show views looking down through about 5 feet of water into the plenum. Figure D shows the reactor vessel head on its shielded platform now in place over the reactor vessel. Defueling will be carried out from a special platform which will replace the work platform.

Thank You

Edwin E. Kintner
Executive Vice President
GPU Nuclear Corporation

Ms. LLOYD. Thank you very much.

Ed, without objection, I would like to have the VuGraph that you presented us made a part of the record of this hearing.

Mr. KINTNER. Absolutely.

Ms. LLOYD. Of course, with any technology there is always progress as a result of change, there is also change to meet market demands as well. But after TMI, unfortunately, and the antinuclear movement and other factors such as poor construction management, it seems like our nuclear reactor market dried up, much to our disappointment.

But at the same time, there seemed to be a perception that all this happened just because of concerns of safety, of the fear of nuclear energy, but we all know that the demand for electricity is here to stay and that our powerplants are getting older and older—like the rest of us.

So the issue that we're really concerned about is will the United States have a better reactor to offer in the immediate future or are we going to become the only industrialized nation to turn away from nuclear power. And it seems to me that our advanced light-water reactors are certainly the only near-term option that we had.

But I suppose that since you're the only one that does not represent industry, I am going to put you on the spot. What is your impression of DOE's advanced LWR Program? Is it aggressive enough? Do you think that this $8 billion budget is going to be sufficient? Just really give us the benefit of your thinking and your experience. Since you don't have to do business with DOE, we felt we'd let you have that one.

Mr. CULLER. Well, Madam Chairman, I will answer the question with the advantage of having been through a review for the Energy Research Advisory Board in a report that will be submitted and available within 3 months of the program.

Basically, we are pleased with the Department of Energy basically is reentering the light water business again, in proposals with a little more scope than in previous years. The program that is proposed is properly directed, but most certainly underfunded. The role that the Energy Research Advisory Board has suggested for the Department of Energy, both in safety research in a report that we finished last year on overall safety, reviewed worldwide, is that there is little creative safety work being done—the PIUS type, other approaches to safety basically of a rather fundamental nature—and that the role for DOE basically not to be covered by industry so well is in these advanced thoughts.

Similarly, for light water reactors, the conceptual designs, the approach is on truly advanced reactors. The industry, through EPRI and in other alliances amongst ourselves, will be able to look with some help from DOE at the evolutionary improvements that can be deployed, I think, starting in the 1990's. And through advances there such as Bert Wolfe has discussed, and the Westinghouse group, EPRI now has a program already discussed with most of the architect-engineers and reactor manufacturers who give the industry some focal point here.

But the Department of Energy's Program must expand to look at some of the advanced concepts and to support some of the rationalization of nuclear power, as Bert has suggested, and others, on how to manufacture, how to standardize, how to improve the inherent safety characteristics of existing light water reactors and to look at the overall possibilities of reducing size in a very realistic way.

I must make the point in all of these systems, however, that the competition for nuclear is pretty high from the fossil area. With the new systems that we're putting on the line in tests, the gasification combined cycles and the fluid beds, we have future technology now about to operate at large scale that will answer the acid rain question. As a consequence, it will be possible to get power probably from coal at levelized costs of 60 or so mills per kilowatt-hour.

All of the new schemes that we propose for advanced light water reactors and advanced reactors in the future must meet that competition; otherwise, the utilities are not in a position basically to opt for expensive new options regardless of size or safety or anything else.

So EPRI's role, and I think the interest of the utilities, is to see the advancement occur, but within the constraints of economic competitiveness over a long period. DOE will be necessary as a supporter for the advanced concepts. The programs are not adequately funded. The amount of money that is available to cover the whole reactor future as it is diminished in every sector, for gas-coal, for LMFBR, for light-water reactors, as it is now funded, will require very difficult and tough decisions to be made by the Department as to how money will be distributed.

Ms. LLOYD. Would you like to recommend a figure for DOE, one that's adequate?

Mr. CULLER. In the Light-water Reactor Program I think the proposals of the, oh, $50 million to $70 million range are probably much too low, and I would expect that to cover the options even in study form will require in excess of $100 million, building to that in a program over several years. And I think as a result of this hearing and the reviews that you're having, a revisiting as to what that level might be is desirable.

Ms. LLOYD. We look forward to continuing to hear from you, and I would also like to hear your perspectives on the acid rain as well.

Mr. CULLER. Thank you.

Ms. LLOYD. As you know, I have a coal bill which I am interested in as well.

Mr. CULLER. Thank you. If you would like, I will answer the question in more substance by letter later on. But we have not really summed up which each sector will be able to bear, the private sector, the reactor manufacturers are likely to do, and what DOE may be able to justify in a budget under the current financial conditions.

Ms. LLOYD. Thank you very much.

Dr. Wolfe, what is DOE's position on the ABWR? Are they planning to participate in the research and development?

Dr. WOLFE. On the ABWR itself we haven't asked DOE to participate. We try to keep them informed on what we're doing, and we have had several reviews for them. This is a program sponsored primarily by the Tokyo Electric Power Co., with contributions by GE, Hitachi, and Toshiba.

The smaller reactor that I talked about, which has innovative safety features for the United States and a smaller-sized 300–600 megawatt, which I just discussed—and we will have provided or will provide a description for the committee—is one again which we have talked to the Department about and which we will submit a proposal for, and we would hope that the Department would support a 2-year program for the development of that type of reactor, which we think is a near-term opportunity to put in safety systems which would be responsive to the particular situation in the United States.

And I might say that we're looking forward to EPRI's program that Floyd Culler mentioned, trying to form a focal point with the U.S. utilities and the manufacturers and architect-engineers. One of the parts of their program is a small light water reactor, and we will be submitting a proposal to them, and we hope that perhaps there could be some integration between the Department of Energy and EPRI in that kind of an effort.

Ms. LLOYD. Thank you.

Mr. Morrison.

Mr. CULLER. Madam Chairman, I failed to make one comment that I think is necessary, if I may. In addition to the longer-term effort, there are certain areas in the short term—the support of TMI cleanup, the areas that Ed Kintner has discussed, and certain very near-term work on the source term—involving the use of facilities that belong to the Department of Energy, LOFT, and other experimental areas. And support in these very important near-term experiments is vital.

There is probably altogether 250 million to 300 million dollars' worth of work going on the source term over the period of the next 18 months and maybe more on an international basis, and the participation of DOE in these efforts and getting the science that's available from TMI and in the source term work is absolutely essential and, in my mind, has priority over the long-term work because of its immediate importance to the overall program.

Ms. LLOYD. Thank you very much, Floyd. I appreciate that.

Mr. Morrison.

Mr. MORRISON. Thank you, Madam Chairman.

Dr. Wolfe and Mr. Gallagher, both of you included in your comments some suggestions that our problems were, in particular with conventional nuclear reactors, are institutional impediments. And I would sort of like to have the benefit of your thinking on maybe a wish list in the licensing reform arena from both of you, just a quick list of what would you suggest to be the most obvious opportunities to remove those impediments.

Mr. GALLAGHER. Congressman, as I mentioned in my testimony, one area where we believe there can be improvement is in the quality-assurance area, as I mentioned, particularly with the last-minute allegations, and the process that we have proposed as a sign-as-we-go process, where we and the NRC agree at the front end of the project with tests and inspections and analysis are required, and as the construction progresses we have a sign-as-we-go process. This process is managed by a computerized configuration management system such that if there are deviations found late in the construction, you have this data base which you can go back and readily correct it. That's one area.

We also support early site approval in the licensing reform, which has been discussed for many years, and also the one-step licensing process. But also, as I mentioned in my summary testimony, we feel very strongly that the incentives for the industry to continue with innovation is provided through the PDA process, and that should be retained in order to have those incentives for industry to bring in innovations into the design process and also into the regulatory process.

Mr. **Morrison**. Dr. Wolfe, I would be interested in your reaction.

Dr. **Wolfe**. Well, I think first a general comment, what we don't have in the regulatory system now which is vitally needed is predictability. There is no assurance. Everyone has lauded St. Lucie of Florida Power & Light, but the fact of the matter is Florida Power & Light would not, and have indicated they would not, commit another one even though they need the power, because when you speak to them, they're not sure that the third plant on that site would get licensed even if it was an identical copy of the other ones.

So I would say predictability in general. We would support standardized licensing. The NRC has, or I understand is about to, submit a licensing package. As I understand the elements of it, it represents—goes a long way toward the kind of changes that we think are necessary. Prelicensed sites we think are important. Certainly, some backfit limit or some rationale that would stop people from making changes—as $1 million a day was being spent—in an arbitrary way without really evaluating the consequences.

One-stop licensing as is done in Japan and France is almost a necessity. When a person is ready to commit $1 billion, he has to know that if he builds the plant as promised, that he'll be able to operate it and he won't be faced with millions of changes.

I think I could go through a lot of details, and certainly my licensing people and the utilities could give you tales of woe. But I would say that I would characterize almost all of them under the term "predictability." And we have a system which is characterized as completely unpredictable.

Mr. **Morrison**. Thank you. Those lists are most helpful. We will be dealing with this issue.

A quick question for an old friend, Ed Kintner.

Ed, once you dispose of the fuel, what's going to happen to the rest of the components from Three Mile Island?

Mr. **Kintner**. Well, as I tried to indicate, we have scoped the cleanup with an end point which is defined as a circumstance which is no further threat to the environment or the workers on the site. No decision has been made about the ultimate disposition of the plant. And certainly, at the moment we don't propose to take it apart. It's right nextdoor to a plant which we hope to be operating soon, 6 years after the accident at TMI-1 and still standing by and waiting for permission to run, but we think will get that permission soon. And the disposition, final disposition of TMI-2, there's no urgency as we see it to make that decision.

Mr. **Morrison**. Are you finding any real surprises?

Mr. KINTNER. At almost every turn there are surprises. When we looked into the top of the reactor vessel and found that it was a pile of rubble, I think that surprised almost everyone. I think almost every time we take another turn on the screw of examining what is happening, we find some additional surprises. And that's I think one of the reasons that I am able to say it's just a giant laboratory. We're learning a very great deal at every step in the project.

Mr. MORRISON. Do you still remain very confident that the system worked in the final analysis?

Mr. KINTNER. Well, the system worked in the final analysis in the sense that there was no harm to the public as a result of the accident. It was obviously a very drastic test of that question. And, yes, we're very much certain of that. And we're also very certain that we can clean it up. I mean, as I said, the total man-rem at this point is low compared to even our estimates, very much below those of the NRC and others, and we expect to be able to continue through the cleanup maintaining that kind of a record of radiation dose.

Mr. MORRISON. So your surprises are on a scale of 1-to-3 as opposed to 1-to-10.

Mr. KINTNER. Yes, I think that's one way of putting it.

Mr. MORRISON. Thank you.

That's all I have, Madam Chairman.

Ms. LLOYD. Thank you very much.

Mr. Fawell, did I get it right today?

Mr. FAWELL. Yes, you certainly did, Madam Chair. Thank you.

Ms. LLOYD. Well, we're proud of our new members. We want to be sure to get their names right.

Mr. FAWELL. Yes. Well, as a new member of this subcommittee I am not familiar with a lot of the nomenclature, and certainly not the PIUS reactor. I am assuming that's not referring to its religiosity. [Laughter.]

But I have two fundamental questions. Will the PIUS reactor be more cost-effective than our conventional LWR's; and, if so, what technical features of the PIUS concept are responsible for its favorable economics? Then, two, will the PIUS reactor be easier to license by the NRC, and why?

Mr. JOHN YOUNG. On the economics, ASEA-ATOM has done a comparison of PIUS at 600 megawatts against two regular BWR's. They deliver a 700 and a 1,050 megawatt. And also against a 600-megawatt coal plant operating in a Swedish environment, because that's what they know. And at that 600-size level, PIUS is competitive; it beats the ASEA BWR, which as I indicatd in my testimony, they're coming in at under $1,500 installed kilowatt right now. So they're beating the United States. So it beats their BWR's and it beats coal with a flue-gas-to-sulfurization under strict emission standards.

The elements of where the cost breaks are, the balance-of-plant would not be regulated by the NRC. It would be a good balance-of-plant, but it would not have the stricture that goes to the nuclear industry from nuclear regulation.

The plant itself is greatly simplified. The entire reactor plant is in a very massive concrete structure. And those advantages offset the fact that the plant operates at a lower efficiency and there's the cost of a massive concrete structure. But when that's added up, the assessment is that it's very competitive against the present-day lightwater reactors and coal at 600 MW.

With respect to licensing, we have submitted our licensing plan. We are engaged with the NRC now. Our whole strategy is different, though. We are not trying to mitigate accidents. We're not trying to have operator actions that are prompt and correct, and we're not trying to have engineered safety systems that will operate with redundancy and, by gosh, they better, that sort of thing. We have preventive strategies that prevent through thermohydraulics and through the containment in a massive concrete structure, the ability ever to have an accident will keep the core covered.

We're finding that our strategies work with the NRC. We're using the present way they do business. You can't go into the NRC and talk about how you're going to do business 20 years ago. You're dealing with the staff just as they work, but we have talked to them, or we are talking to them, about new strategies. They are agreeing with us.

So, I say that, yes, we're going to have a standardized design that is licensable and licensable in areas where lightwater reactors won't go, like New England. So we're having a lot of success. That's our constituency here in the United States. Where we make sense is with the NRC.

Mr. **Fawell**. Fine. Thank you.

Mr. **Culler**. Mr. Fawell.

Mr. **Fawell**. Yes.

Mr. **Culler**. An additional comment. As part of the EPRI industry program, we have already had two contracts to begin looking at PIUS in a very comprehensive way and, as reported, have had a design review discussion. It will be part of our evaluation both economically and stabilitywise over a longer period of time and in close cooperation with ASEA-ATOM and Oak Ridge and the Nuclear Regulatory Commission. So we will make it a part of the evaluation to see whether in U.S. conditions the same kind of economics can be realized, and it will come out over a period of time and somewhat at the same pace as is being evaluated for the smaller reactors and other things like that.

Mr. **Fawell**. Thank you.

Ms. **Lloyd**. Thank you, Mr. Fawell.

We're very happy that the ranking Republican member of the full Science and Technology Committee is with us this afternoon, Mr. Lujan.

Mr. **Lujan**. Thank you, Madam Chairman. I am sorry to have been delayed.

Ms. **Lloyd**. It's good to have you back in the fold again also.

Mr. **Lujan**. Thank you. Thank you.

I don't know if we've addressed the question of looking beyond, say, the early or middle 1990's when all the plants that are under construction now but not completely finished. It seems like we're coming to a particular point where we've got to start looking at what happens beyond that, whether it's smaller ones or just what we do beyond that. Has that been discussed?

Ms. **Lloyd**. Do you want to answer that, Floyd?

Mr. CULLER. Congressman, I think that the thrust of the discussion so far today and much of the testimony that will be on file divides very clearly in all of this approach. First, what has to be done to take care of those reactors that are coming on and being constructed now. But the important thrust of the testimony today is what do we do after that. And there are three principal lines. One is that there is an evolutionary improvement already well along, and GE and Westinghouse and the other reactor manufacturers.

A second advanced reactor approach, where we evolve better reactor designs, easier to build, safer, more reliable; and then a truly new concept program, more in the realm of DOE funding and such, where good ideas such as PIUS, perhaps, and the other smaller reactors and smaller packages, more easily constructed, more reliable, perhaps with greater safety features; many other—longer in life with much longer longevity.

All of these are proposed within a network of programs which seem to be moving into place, part with DOE, but DOE-underfunded; certainly, in safety, with the NRC; and a significant contribution in the private sector.

Mr. LUJAN. Yes.

Mr. CULLER. Now, over time I think you'll find that these knit together a little bit better than we may be presenting them today, because there is a huge amount of cross-talk that's coordinated with DOE, that's coordinated amongst the industry reasonably well. And I think that the things that you are hearing have a common thread.

So I think that today's testimony will provide the record with some really relatively good directions to take in this thrust that you ask about.

Mr. LUJAN. Are you talking particularly about standard designs? I imagine that's incorporated in it. My question was really directed at the utilities perhaps today looking down the road can't afford the $2 to $3 billion kind of machines or plants that we're looking at today, and it seems to me like there must be some real effort directed at where do we go from here. I don't know, also, if your testimony has been in looking at what we do in the area of lightwater reactors, but whether it's directed at looking at gas-cooled reactors and those kinds of things.

Mr. CULLER. The testimony so far, that to which I referred, was exclusively on light water reactors. The industry itself is looking quite seriously at light water reactors, and within the EPRI organization we have proposed now for 3 years and had approved by our board in December a rather massive LWR improvement program in three phases: help those being built and operating; second, evolve a better design based on what we already know; and explore new concepts and, over a period of 5 years or so, to evolve standard designs, hopefully much less costly in dollars per kilowatt and much more reliable, much higher onstream efficiency, and can be built in shorter periods of time.

You'll find all of those elements referred to in the testimony.

Mr. LUJAN. But strictly under the LWR and the testimony has not covered nor are you——

Mr. **Culler**. Not yet, but there are similar programs that are emerging to look ahead to the gas-cooled and certainly ahead to the liquid metal reactor, both nationally and internationally. I think they will emerge later in the day.

Mr. **Lujan**. All right. Thank you.

Ms. **Lloyd**. Thank you, Mr. Lujan.

At this point I would like to make a sort of clarification statement. Since we are covering such a broad range of testimony today, obviously we will not have as much time to ask as many questions of our witnesses as we would like. But since we do want the record to be complete we are going to ask all of our witnesses to reply to questions in writing, and it will be made a part of this record.

Of course, these records will be available for those who are interested at a later date. You may ask why is this necessary. Well, first of all, we didn't get the President's budget, as you know, until the first week in February. Then immediately, the Congress went out on a district work period and here we are back this week and as you know, we have to have this wrapped up by the end of March.

I regret that this is the situation, but nevertheless, we have to work within these constraints. But please don't think that we are taking any of our witnesses lightly and that we're not spending any more time with them, because we certainly will have, I think, a complete testimony if you would agree to questions in writing that we were not able to cover in these hearings. And we do thank you for the benefit of your wisdom, your time, and your preparation of your testimony today. Thank you very much.

Our next panel of witnesses represent the Modular High-Temperature Gas-Cooled Reactor Program. We have Mr. Richard Walker from the Gas-Cooled Reactors Associates; Dr. Kerry Dance from GA Technologies; Mr. Warren Chernock, Combustion Engineering; Dr. Bertram Wolfe, General Electric; and Mr. Milton Levenson of Bechtel Corp.

Gentlemen, we welcome you.

I would also like to mention that Stone and Webster has provided testimony for the record for this hearing as well.

Mr. Walker, you may proceed. We have your testimony and you may proceed as you wish, but your complete testimony will be made a part of the record. It's good to see you back again.

STATEMENT OF RICHARD F. WALKER, PRESIDENT, PUBLIC SERVICE CO. OF COLORADO, AND CHAIRMAN, GAS-COOLED REACTOR ASSOCIATES

Mr. **Walker**. Thank you, Madam Chairman.

Ms. **Lloyd**. Thank you.

Mr. **Walker**. My name is Richard F. Walker. I am president of the Public Service Co. of Colorado, and I am chairman of the Gas-Cooled Reactor Associates. The Gas-Cooled Reactor Associates is a group of electric utilities in the United States. Our constituency represents about 35 percent of the installed generating capacity in the United States. Our group was formed in 1978, and we have a staff in our headquarters in San Diego that is entirely financed by utility contributions.

Our purpose in life was—we started in 1978—was to preserve the high-temperature gas-cooled reactor option, and we've continued with many studies since that time. We're still convinced that it has some unique features that are worthy of consideration.

Other speakers have addressed the situation of what I call the nuclear window. There have been no orders for a good many years. We're getting down to many of the plants being completed, and we feel, certainly as a representative of the utility industry, that maybe it's a good time to look at the whole nuclear option not only from the concept of the different types but also from the size and what kind of institutional arrangements are we going to have to have in order to have the nuclear option as a viable alternative to us as we proceed through the rest of this century and into the next.

I think no one will deny that the growth of electricity will continue. There is some debate on the rate. But it will continue. There are old plants to be replaced. So we do need the nuclear option. I don't believe there is any question about that.

As far as the advanced nuclear systems, we obviously support the high-temperature gas-cooled reactor system because of its unique capabilities for high-efficient electric generation, process heat, cogeneration, and as I have testified before, because of its inherent material characteristics, ceramic fuel, graphite and helium. This does meet safety and licensing requirements with minimum reliance on engineered safeguards. It does provide substantial time, measured in hours, for operator response in case of upset conditions. And it provides added margins for protection of plant investment, provides additional siting flexibility, and it assures a very low radiation exposure of the plant personnel.

During the last 15 months, in cooperation with DOE and other participants, the vendors and the architect-engineers have carried out an evaluation program looking primarily at the size question. And we now have come up with what I call kind of a decision point. Our preferred concept now for deployment is a steel vessel modular design. We're looking at individual reactor units of about 100 megawatts electric. They could be shop-fabricated with the whole nuclear steam supply system put in a vessel and all fabricated in a shop.

This has some obvious advantages, as has been addressed before. It would be much easier to control the quality in a factory environment than it is in the field environment. For the balance of this year and the next few years we will be looking at refining this concept and looking at some of the greater details involved in that.

We believe the most effective approach for advancing the modular HTGR to a point where it might be available for commercial development is through the conduct of ~~a~~ full-scale licensing and technology test project. The key objective of the licensing and technology test project would be to implement the license by test concept; in other words, a full test of the full-size model.

We certainly continue to look for DOE's help in international cooperation, and we of our own volition are working particularly with the Germans on collaboration on the private side as far as their international arrangements.

With regard to the 1986 budget, we do have a recommended level, Madam Chairman. It's higher than what DOE came in with.

We are recommending a level of $38 million, which includes the Spent Fuel Management Program. This is about the same level as we had last year.

The emphasis in the program would be on advancing the design of the modular HTGR and the preparation of a preliminary safety information document to be used as the basis of an NRC review and issuance of a licensability statement.

Also, as I mentioned before, the licensing and technology test project plan would need to be prepared by the program participants so that we could support the 1987 budget request.

The proposed budget level would support expeditious and efficient implementation of such a project and provide strong evidence that this could be an alternative as we move on into the future in the electric supply situation.

Since I am the owner and operator of the Fort St. Vrain nuclear generating plant, I would like to bring you up to date on that facility. When I was here last year—we had had a good year in 1983—we were shut down for refueling in the spring of 1984 and for some system modifications, which we continually make on the system. I think most of you know that history. We continue to add to the plant to get it to operating better. We have a budget this year of some $16 million in capital expenditures to improvement of systems.

We're doing some of that. We came back on the line in the summer. Unfortunately, we had an incident where six of the control rods malfunctioned. This didn't cause any safety problems, but it certainly was a serious technical problem. As we investigated it—and I won't bore you with the details —it turns out to be corrosion of some of the components, and so we're in the process of refurbishing all 37 control rods, not just the 6 control rods. That work is going on now, and we hope to have the plant back in operation in a relatively short period of time.

It's unfortunate that these things happen, but that's what demonstration plants are for, and we will end up with better control rods and a better understanding of some of the problems that we've had with moisture ingress.

Certainly, we think this is a very good concept. We believe it's responsive to the utilities' needs. I as a CEO of a utility company, am very worried, as one of the Congressmen said, about $2 and $3 and $4 billion investments in new facilities. I am looking for a mechanism where we can maybe take this in smaller bites, if you would excuse the expression. I think the modular concept is one way that may work for us, particularly if they can be built in a much shorter period of time. Certainly, those institutional arrangements are very important dollars to us, in a regulated industry are very important, and if we're not going to be able to get the plant done and get it in the rate base, we've got some very serious problems. So in spite of the technology, that's an overriding consideration for many of the utilities.

We certainly want to capitalize on the unique characteristics of the HTGR. We believe they're good. We believe they have some real appeal to the general public. And we think that is an area that needs to be looked at very carefully.

We're pleased with the progress we've made working with the vendors and with the architect-engineers. And we really look at it as a team, and we hope that out of all of this and everybody working together—we obviously have some disagreements with some of the other parties—but we feel we can kind of come out of this with a joint supplier company, if you want to call it that, where we can go forward before the end of this century with a good HTGR modular concept.

We obviously, as time goes on would not put these in at 100 megawatts single; they would go together in clusters, whether that would be 4 or 6 or whatever it might be. But we think it has a lot of advantages, and we certainly are pleased that DOE has supported the project to this date. We'd like to see the funding a little higher so that we can move forward.

That's a very brief summary, Madam Chairman. I would be glad to answer questions after the rest of the panel has concluded. So I will turn it over.

[The prepared statement of Mr. Walker follows:]

STATEMENT SUBMITTED FOR THE RECORD
SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION
COMMITTEE ON SCIENCE AND TECHNOLOGY
UNITED STATES HOUSE OF REPRESENTATIVES

FY 1986 DOE AUTHORIZATION
HIGH TEMPERATURE GAS-COOLED REACTOR PROGRAM

RICHARD F. WALKER
PRESIDENT OF PUBLIC SERVICE COMPANY OF COLORADO
AND
CHAIRMAN OF GAS-COOLED REACTOR ASSOCIATES

Madame Chairman and Members of the Subcommittee, my name is Richard F. Walker, and I am President of Public Service Company of Colorado and Chairman of Gas-Cooled Reactor Associates (GCRA) which is a utility/user organization that supports the development of the High Temperature Gas-Cooled Reactor (HTGR). At present, the GCRA constituency represents approximately one-third of the installed generation capacity in the U.S. In addition, participating GCRA utilities have a substantial investment in and extensive experience with nuclear power. This background of nuclear experience provides GCRA with a sound base for evaluating the HTGR as a commercial alternative. GCRA's role is to apply this base of experience in guiding the development of the HTGR to be fully responsive to utility/user requirements. A GCRA staff, supported solely by utility funds, has been in place since 1978 conducting HTGR concept evaluations, Project planning and development activities, and Program integration support services to DOE, including the management of architect-engineer (AE) resources.

The bases for utility/user interest in the HTGR are the unique characteristics that distinguish it from the current generation of nuclear power systems. The most notable of these features are the inherent safety and low environmental impact characteristics that translate to minimal reliance on engineered safety systems, substantial time (measured in hours) for operator response to postulated reactor upset conditions, added margins for plant investment protection and siting flexibility, and low radiation exposure of plant personnel. Furthermore, the HTGR is an evolutionary technology that extends beyond near-term power and cogeneration applications to advanced concepts for power generation and process heat.

GCRA's objective is to establish the HTGR as an attractive commercial alternative for a broad range of applications in a timely manner. The approach to achieving this objective has been to establish an initial HTGR Project after which commercial plants can be deployed. In achieving this objective, the maximum use will be made of the past 35 years of worldwide gas-cooled reactor technology, demonstration and application. In the near-term, the objective is to develop an HTGR design that is responsive to the utility/user's requirements, eases the current institutional difficulties associated with nuclear power and optimally capitalizes on the HTGR's unique characteristics.

During the past year, a comprehensive evaluation effort has been undertaken within the HTGR Program of various smaller, simpler HTGR design concepts. Through this effort, a consensus has been reached among the private-sector participants on the key elements of the HTGR Program. In particular, the preferred concept for near-term development and deployment emphasis is the steel vessel, modular design. Resources for the near-term, including the balance of 1985, should be focused on pursuing this concept to establish whether there is a sufficient basis for Project commitment. Key distinguishing features of the modular HTGR include:

1. The core size and power density are limited such that the fuel particle coatings retain the fission products to an acceptable degree under all licensing basis events, with decay heat removal being accomodated by the passive mechanisms of radiation and conduction. This feature is expected to simplify the overall concept, particularly the licensing and operations activities.

2. The nuclear steam supply system and other systems within the nuclear island are shop fabricated and assembled to nuclear standards, while the balance of plant is largely manufactured and constructed to conventional fossil plant standards. This is expected to improve the productivity and reduce the schedule and field erection costs.

3. The plant is composed of independent reactor units of approximately 250 MWt/100 MWe that can be constructed as a cluster of modules or sequentially constructed to more closely match load growth requirements and the utility's financing constraints.

The preferred strategy for deploying the modular HTGR is through a Licensing and Technology Test Project that would be used to implement the "license by test" concept as well as to demonstrate the performance, cost and schedule features of the modular HTGR. Further, international cooperation, particularly with the Federal Republic of Germany, should be expanded to the maximum degree in order to reduce the overall costs and risks to the U.S.

A major ongoing effort within GCRA has been to coordinate the private-sector efforts in support of such a Project initiative. To this end, exploratory activities are underway to establish a consolidated vendor/supplier/AE entity that can efficiently design and build the Licensing and Technology Test Project. The intent is that upon successful completion, multiple vendor entities would be able to offer commercial modular HTGR plants. In addition, efforts are continuing to establish the detailed utility/user requirements of such a Project, candidate sites, host or supporting utility arrangements, as well as arrangements for broad utility support for the Project.

With regard to DOE's HTGR budget for FY 1986, it is recommended that the Program be funded at a minimum level of $38 million, including $2 million for capital equipment. The emphasis of the DOE Program should be on advancing the design of the reference modular HTGR and the preparation of a Preliminary Safety Information Document (PSID) which will be used as a basis for NRC review and issuance of a licensability statement. In addition, a Licensing and Technology Test Project Plan should be prepared for support of the FY 1987 budget request. Government support for the proposed budget level would be invaluable in nurturing the continued development of private-sector and international support for a Project commitment plus provide strong evidence of the U.S. support for revitalizing nuclear power.

On the local front, I would like to update you on the Fort St. Vrain power plant. Last year, I reported to you about the improving performance of the plant, but unfortunately, this trend did not continue through 1984. On January 20, 1984 the plant underwent a planned shutdown for its third refueling along with an extensive refurbishment and maintenance program that lasted until the second week in June. Shortly after the plant was restarted, a plant upset occurred which resulted in a significant ingress of water into the primary coolant system via the helium circulators' bearing seals. In the subsequent safe shutdown, it was observed that six pairs of control rods failed to drop into the reactor. While this event in itself posed no safety hazard, the subsequent investigation revealed that excess moisture in the primary helium system had caused a corrosion problem in the control rod drives. During the past months, we have made the appropriate improvements at the plant and we are currently refurbishing the control rod drives. We hope to be able to restart the plant before long.

In spite of such first-of-a-kind difficulties, it should be recognized that Fort St. Vrain has provided critical confirmation and demonstration of many inherent HTGR features. For example, the amount of radioactivity carried in the helium coolant has been less than two percent of the design limit, demonstrating the structural integrity of the coated fuel particles. Personnel exposure data for the U.S. indicate that Fort St. Vrain has had an average annual person-rem exposure rate per GW(e)-year approximately a hundred times lower than the rate in light water reactor plants. This low personnel exposure level is probably the lowest of any commercial nuclear plant in the world and is even more significant in view of the fact that Fort St. Vrain allows virtually unlimited access into the reactor building for all operations and maintenance personnel. As another example, temperature transients have been slow and predictable, even during periods of temporary loss of forced cooling, demonstrating the large heat capacity of the core. Operation to date has achieved 1000°F steam temperatures and a net efficiency of 38.5%--the highest of any nuclear plant in the U.S.

As part of a continuing commitment to improve the performance of Fort St. Vrain, Public Service Company of Colorado plans to spend about $16 million in 1985. Furthermore, lessons-learned are being incorporated by the Program in subsequent HTGR designs. For example, a new helium circulator design, possibly using an electric motor drive and magnetic bearings that do not require water, is being investigated for possible application in the modular HTGR and might even be able to replace the existing circulators in Fort St. Vrain. We are confident that Fort St. Vrain will become a reliable source of kilowatt-hours for our customers as well as continue to provide critical information regarding the demonstration of HTGR systems and components. My Company is proud of our role as owner/operator of Fort St. Vrain and we remain committed to the HTGR concept.

Madame Chairman, I appreciate the opportunity to present the utility/user support and perspective on the HTGR Program to your Subcommittee. With your continued support, we will bring to fruition an HTGR Program that is responsive to utility/user needs and the nation as a whole.

Ms. LLOYD. You beat your time. You did well.

You said there were some complications, some problems. You've got a couple of minutes left.

Mr. WALKER. Oh, you mean as we work with our vendors?

Ms. LLOYD. Yes.

Mr. WALKER. Well, that's true any time you——

Ms. LLOYD. Is there anything you would like to elaborate on?

Mr. WALKER. I can a little bit.

Ms. LLOYD. I think you've got 2 minutes left.

Mr. WALKER. All right. [Laughter.]

Obviously, when you get engineers and scientists together and systems people, there can be disagreements maybe on the arrangement of the plant, maybe on the type of fuel and various components. And I think that's healthy. I think everything needs to be looked at. We've come up with a steel vessel. Obviously, an alternative to that would have been a prestressed reactor concrete vessel like we have at Fort St. Vrain. But we've settled that now, and we feel the steel vessel is the best for this modular.

So those are the kinds of things. Maybe that was an unfair characterization to say there are real problems. I think there are points of discussion that you have to work out in any process. And I would observe that if you don't have those kinds of controversies come up, you're probably not thoroughly investigating the problem.

Ms. LLOYD. Well, thank you. I appreciate that very much.

Mr. WALKER. Yes.

Ms. LLOYD. Dr. Dance, please proceed.

STATEMENT OF DR. KERRY D. DANCE, PRESIDENT, GA TECHNOLOGIES, INC.; ACCOMPANIED BY DR. RICHARD A. DEAN, VICE PRESIDENT, REACTOR PROGRAMS

Dr. DANCE. Yes, Madam Chairman, and other members of the subcommittee. I am Kerry Dance, president of GA Technologies. I am accompanied today by Dr. Richard Dean, our vice president of Reactor Programs, whose responsibilities include all HTGR activities at GA. I appreciate your providing us this opportunity to testify before your committee on the progress that has been made during the past year and to talk about future directions.

I might note that the long-term support and guidance of this committee has been vital to the HTGR program, and your subcommittee's initiative for a smaller passivly cooled factory-fabricated plant has been gaining worldwide attention and is recognized maybe as a possible key to the return of any nuclear future in this nation.

Ms. LLOYD. Of course, I appreciate that our goal is to keep the nuclear option alive and to proceed as best we can with new concepts in the meantime.

Dr. DANCE. Yes.

Ms. LLOYD. I think that these objectives, if we stay on track, will be accomplished.

Dr. DANCE. We certainly hope so.

We are also pleased, as Dick Walker mentioned, by the continued support of the Department of Energy and the administration as evidenced by the inclusion of this program in the fiscal year 1986 budget.

We at GA feel strongly that a complementary effort in addition to those in support of LWR's is needed to give any assurance of a rebirth of nuclear power in this Nation. Public perceptions, lower load growth, and financial uncertainties may all prevent an easy return to the building of large LWR's.

Quite frankly, we hope this is not the case. We would like to be out there competing and selling HTGR's in a viable and expanding market. But the reality is that there is no certain market in this country at this point in time and a small, passively safe, easily constructed nuclear system may be needed to lead the rebirth of nuclear in this country.

We fully support, therefore, your initiative for development and demonstration of an inherently safe reactor system and feel it should receive high priority in the total fission budget.

We are pleased with the progress of the program to date. This progress is reflective of the cooperation and the contribution made by all the participants, including Combustion Engineering, General Electric, Bechtel, Stone & Webster, and Oak Ridge National Laboratory.

In particular, I would also like to acknowledge the contributions of the Gas-Cooled Reactor Associates, GCRA, which is the utility user organization providing the perspective and the requirements of the users for this program. Their efforts in bringing consensus and getting all the scientists and engineers to battle these things out and reach conclusions has been and will be crucial to the program.

GA, which has been at the center of gas-cooled reactor technology and commercial activity in the United States, continues as a principal contractor on the Department of Energy's HTGR design and development program. We continue to be enthusiastic about its merits and over the prospects for the concept to make a major contribution.

We look forward to the opportunity of applying our HTGR technical expertise to the program, an expertise I might note which came out of an investment of something like $500 million worth of private money.

Our one concern in the program is that we may not be able to focus the program, bring all the proper resources to bear, and set out to accomplish a real project given the budget and time constraints.

For our part, we will attempt to do all in our power to see that our technology is brought to bear. GA is also committed to seeing that all of the tremendous nuclear talents in this Nation and elsewhere are brought to producing a successful system. Besides our unique HTGR technology base, we believe the experience offered by HRB and NUCHEM in Germany can greatly aid the program. We believe the acknowledged expertise of Combustion Engineering in total powerplant system supply can help assure hardware success, and we feel that the contributions of the other program participants will greatly aid the program.

Of particular significance in this vein is our longstanding relationship with HRB in West Germany. HRB was the designer and a participant in the construction consortium for both of the pebble bed reactors built in Germany, the AVR and the THTR. GA also maintains a cross-license agreement with NUCHEM, the German HTGR fuel technology and fabrication company. These relationships and the associated commercial agreements have allowed the experience of the gas-cooled reactor programs in the Federal Republic of Germany to be brought to bear on the U.S. program, and vice versa.

Also of significance are efforts underway between GA and Combustion Engineering to assure that hardware know-how and the years of powerplant experience of groups like Combustion Engineering are brought to bear in the building and the licensing in the technology test project. We also continue to support the involvement in the program by GE, by Bechtel, by Stone & Webster, and by Oak Ridge National Laboratory.

I would like now to give a few more specific comments on two phases of the program, the modular HTGR Program and the Spent-Fuel Treatment Program.

In regards to the modular HTGR Program, the work on the DOE program during the last year has concentrated on detailed evaluations of several different systems which we're established and which were checking against criteria established by GCRA, by all the program participants.

The intent of the program is to select a single preferred concept and to move rapidly from that point down the path to a coordinated, multiparticipant, project-oriented activity. The preferred concept to date is of a steel vessel, a passively safe modular HTGR with coated fuel particles. Work to date has indicated that such a system in a multimodule format of about 400 megawatts will be competitive with LWR's and coal.

Recognizing an essential object is a licensing certification of an individual module, participants in the program have proposed that the most logical approach to proving the principle would be to carry out a licensing and technology test project. The primary purpose of this project would be to demonstrate the licensability by actual performance of a predetermined set of licensing basis events; in other words, really show that under all kinds of scenarios that it really is completely, absolutely, passively safe.

These events would be determined in conjunction with the NRC, in completion of the tests with acceptable results would be basis for the issuance of a certification of licensability. We're talking about something more like what the FAA does in aircraft: Get a design, certify it, and know that you have a design, if you build it like that, you can continue to build it.

The second, and equally important objective of the project would be to validate the costs, schedule, equipment performance, and investment risk protection capability.

GA fully supports the licensing and technology test project. We believe such a project would consist of a single module and should be designed as a Government project. This project would permit broad participation of all the interested organizations, and to the extent reasonable, the project would make use of technology made available through international agreements. Information provided to or developed in support of the project would be made available to others at the Government's discretion while protecting the rights of the participating organizations.

For fiscal year 1986 we recommend a funding level of $36 million—this is the same as Dick Walker's $35 million—that includes $1 million of capital, to permit the program to progress at a cost-effective pace. We could spend more money, but we recognize the constraints and we're talking about essentially a level program. GA would continue to commit our own private resources in support of the program.

I would like now to say just a few comments on the Spent-Fuel Treatment Program which is under the direction of Oak Ridge National Laboratory and which has been an integral part of the program for many years.

The focus of this activity is on the requirements, technology, and costs associated with the handling, transportation, processing, and ultimate storage of materials discharged from the HTGR fuel cycle. GA believes that the continued evaluation of the development of the spent-fuel treatment are important to the overall program and should be continued at essentially a level effort of $3 million a year.

In summary, then, recognizing the tight fiscal constraints that you are working within, and despite our desire to move quickly, we recommend an essentially level funding for fiscal year 1986 of $36 million, as I said, including $1 million of capital, for the HTGR Program, with emphasis on a single project of licensing and technology test project; and two, a funding level of $3 million for the Thorium Recycle Program.

Thank you for the opportunity to testify. I would also like to thank the staff for setting up the meeting.

[The prepared statement of Dr. Dance follows:]

STATEMENT SUBMITTED FOR THE RECORD

SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION

COMMITTEE ON SCIENCE AND TECHNOLOGY

UNITED STATES HOUSE OF REPRESENTATIVES

FY 1986 DOE AUTHORIZATION
HIGH-TEMPERATURE GAS-COOLED REACTOR PROGRAM

KERRY D. DANCE
PRESIDENT

GA TECHNOLOGIES INC.

February 21, 1985

Madame Chairman:

I am Kerry D. Dance, President, GA Technologies Inc. and I am accompanied today by Dr. Richard A. Dean, our Vice President of Reactor Programs whose responsibilities include the High Temperature Gas-cooled Reactor.

I appreciate your providing me this opportunity to testify before your Committee on the significant progress made during the past year on the High Temperature Gas-Cooled Reactor program and to offer our recommendations on funding and future program direction.

The long term support and guidance of this Committee has been vital to the HTGR program. As we have interacted both internally among the program participants and externally in national and international forums, it has become apparent that your Subcommittee's initiative for smaller, factory fabricated reactors having enhanced passive cooling during accident conditions, has been gaining world-wide attention and is recognized as a possible key to the future of nuclear power. Your guidance is certainly recognized in the current activities and future direction of the HTGR program.

We were gratified this past year by the actions of the Department of Energy in refocussing the HTGR program to respond to the Congressional guidance and the changing user and industry needs. We are also pleased by the continued support by the Department and the Administration for the program as indicated by the inclusion of the HTGR as a part of the FY'86 fission budget.

The vitality and progress of the program this past year is reflective of the cooperation and contribution made to the HTGR program by all of the major program participants including Combustion Engineering, General Electric, the Bechtel Group, Stone and Webster Engineering Corporation and Oak Ridge National

Laboratory. In particular, I would like to cite the role and contribution of Gas Cooled Reactor Associates (GCRA), the utility/user organization which provides to the program the current perspective and requirements of the ultimate user of HTGR systems and, in addition, performs for the Department of Energy the overall program coordination function. Their efforts have been most important in bringing together and developing a consensus among the program participants on the key elements of the program. These positions are reflected in the joint statement which has been submitted to the Committee by R. E. Walker, President of Public Service Co. of Colorado and Chairman of Gas Cooled Reactor Associates.

GA, which has been the center of gas cooled reactor technology and commercial activity in the United States, continues as a principal contractor on the Department of Energy's HTGR design and development program. We continue to be enthusiastic about the technical merits of HTGR's and over the prospects for the concept to make a major contribution to our future national energy picture. We look forward to the opportunity of applying our unique HTGR technical capability and experience (much of which resulted from our private investment of over $500 million) built up through our participation in essentially all facets of the U.S. gas cooled reactor program from inception. This is augmented by our involvement in international gas reactor programs through ownership, license, technical exchange agreements or contract activities.

Of particular significance to the HTGR program at this time is our long standing relationship with Hochtemperatur Reaktorbau (HRB) in West Germany. GA is a 45% owner of HRB with Brown Boveri & Cie, the owner of the other 55% share. HRB was the designer and a participant in the construction consortium for both pebble bed high temperature gas cooled reactor plants which have been installed in Germany - the AVR and THTR plants. GA also maintains a cross-license agreement with NUKEM, the German HTGR fuel technology and fabrication company. These relationships and the associated commercial agreements have allowed the experience of the gas cooled reactor programs in the Federal Republic to be brought to bear on the U.S. HTGR program and vice versa.

My testimony today will amplify on the joint statement submitted by GCRA and will deal principally with the Modular HTGR (MHTGR) which has received the major emphasis in the program during the past year. I will also address the status of the large, integrated HTGR design activities and the Thorium Recycle program which is under the direction of the Oak Ridge National Laboratory.

We concur with the position expressed by the Committee that a significant impediment to the revitalization of the nuclear industry is the lack of confidence and acceptance of current nuclear systems and the nuclear infrastructures by significant segments of the public and other interested groups. This attitude may, in part, be ameliorated by the concerted effort being applied by utilities, suppliers, contractors and the government in their respective areas of responsibility. We believe, however, that a complementary approach, as identified in your initiative, of smaller, passively safe systems should be vigorously pursued. The benefits of nuclear energy are too great to ignore this alternative solution. We, at GA, fully supported your initiative for development and demonstration of an Inherently Safe Reactor System and believe that the HTGR class of reactor best meets the requirements.

MODULAR HTGR PROGRAM

The work on the Department of Energy program during the past year has concentrated on detailed considerations of several HTGR nuclear systems and overall plant configurations which could meet the criteria that were established by the program participants. These criteria evolved from a compilation of specific requirements related to safety and investment risk that are more stringent than current criteria, take into account the full benefit of the inherent capabilities of the HTGR system and the experience gained, both in the United States and the Federal Republic of Germany, on the actual design, construction and operation of these systems.

The intent of the program is to select a single preferred concept by the end of February and to move rapidly from that point down the path of a coordinated, multi-participant and project-oriented activity to demonstrate the properties of this concept.

The preferred concept has been identified by the participants as the U.S. design of a steel vessel modular HTGR. Each individual module would have a power output of 250 to 350 MW(t) and a reference plant concept would consist of multiples of these modules coupled to a single turbine generator. Each of the modules would incorporate a reactor core of HTGR-TRISO coated fuel particles in a graphite matrix. The physical dimensions and the power density of the core are determined by the requirement that, under severe accident conditions the nuclear afterheat can be transferred by totally inherent conduction and/or radiation to totally passive heat removal systems. Under such conditions, the fuel particles would not reach temperatures which would cause significant fission product release from the coated particles. Radiation levels would be at a low level such that consideration of evacuation plans within the user's emergency planning would not be required and moreover the user's investment would not be jeopardized.

Assuming full credit is obtained from the licensing authorities for these features, considerable simplification of the total plant would be obtained since all of the nuclear requirements would be localized and the balance of the electricity generating plant could be built according to conventional construction standards. This separability factor, coupled with the ability to factory-fabricate the majority of the nuclear system would lead to significant reduction in overall plant costs. The work to date has indicated that the multi-module 400 MW(e) plant can be made to be competitive under these assumptions.

Recognizing that the key assumption is the licenseability of the individual module, the participants in the program have proposed that the most logical approach to proving the principle would be to carry out a Licensing and Technology Test Project leading to a licenseability certificate from the NRC.

LICENSING AND TECHNOLOGY TEST PROJECT PLAN

The primary objective of the Licensing and Technology Test (LTT) Project would be to demonstrate the licenseability of the concept by the actual performance of a predetermined set of licensing basis events. These events would be determined in conjunction with the NRC and completion of the events with acceptable results would be the basis for the issuance of a "certificate of licenseability" for the concept.

A second and equally important objective of the project would be to validate the costs, schedule, equipment performance and investment risk protection capability of the concept. This would involve not only the close monitoring of work progress but also significant design and performance reviews throughout the project and the actual performance of predetermined design basis events pertaining to equipment reliability and equipment failure and repair. This objective would be met through review and test specification procedures established in conjunction with a user group.

To meet these objectives in a cost-effective manner, GA recommends the following approach:

1. The performance of a LTT Project utilizing a single module become the defined goal of the DOE HTGR program and that the effort by the participants in the program be focussed on this activity as soon as possible.

2. The LTT project should be defined as a government project built on a government site.

3. The LTT project should be structured to permit the broad participation of qualified and interested organizations whose roles would be consistent with the effective utilization of each organization's pertinent background and experience.

4. Information provided to or developed in support of the the LTT project would be made available to all interested and qualified organizations at the government's discretion, with qualification that the rights of the participating organizations contributing to the project would be protected.

5. To the extent reasonable the project would make use of technology available through cooperative international agreements.

GA believes that the Licensing and Technology Test project should be designated as a goal of the HTGR program as soon as possible. We would also recommend that the level of funding for the HTGR design and development program activities for FY'86 be increased from $26 million requested by the Administration to a level of $36 million. This program level would permit the program to progress at a more cost effective pace, permit significant licensing activities and the early initiation of Title I design activities for a LTT project.

GA Technologies is prepared to work together with the other industrial participants and the government to evolve an organization to effectively carry out such a project and to assure program access to pertinent technology and experience. We would, of course, also intend to continue to commit private resources to the support of the HTGR program.

INTEGRATED HTGR PROGRAM

Although the major effort on the HTGR program during the past year has been on the small, modular HTGR, there has been a continuing user interest in the so-called "Integrated" HTGR designs. These designs are characterized by configurations in which the reactor core and the primary loops are integrated within a single prestressed concrete reactor vessel. A significant accomplishment during the year was the completion by the program participants of the conceptual design and related baseline documentation for the 2240 MW(t) [860 MW(e)] plant. This design which represents 20% of the total engineering effort, has served as a benchmark for comparisons on costs, schedules, relative safety and investment risks between all of the other concepts. In particular, the design also served as a departure point for the consideration of smaller integrated plants and the potential for attaining an even greater degree of passive safety in line with your initiative.

The integrated plants designs that were studied during the year were in the power output range of approximately 400 MW(e). Design improvements were incorporated in these designs to lead to increased levels of inherent safety and significantly reduced probabilities for significant fission product release.

We continue to believe that such integrated plants could also play a major role in the national energy picture. Both the integrated plants and the modular plants could be used for electricity generation and for the cogeneration of electricity and high temperature steam for use by process industries. Many of the larger utilities in the GCRA user group and other utilities with large installed capacities and reasonably large projected growth rates also foresee a possible role for these large integrated systems.

However, GA recommends, that in the near term the program efforts be concentrated on the small modular concept and the LTT project.

THORIUM RECYCLE

The Spent Fuel Treatment Program, under the direction of the Oak Ridge National Laboratory, has been an integral part of the National HTGR program which has been supported and funded by your Committee. The information from this activity which focuses on the requirements, technology, and costs associated with the handling, transportation, processing and storage of discharged fuel is vital to the overall consideration of HTGR reactor systems.

The fuel uranium/thorium cycle for the modular HTGR designs utilizes low enriched uranium (LEU) fuel--approximately 20% enriched U-235. Management of the spent fuel for modular HTGRs on a once-through fuel cycle involves shipping and storage activities in various sequences prior to packaging and ultimate disposal of the HTGR spent fuel in a geologic repository. The cost of managing these back-end fuel cycle activities can be favorably impacted by the application of spent fuel treatment process technologies currently under development in the United States and the Federal Republic of Germany. Many of these processes have been jointly developed in a cost effective manner under the U.S./FRG cooperative program. In particular, volume reduction of HTGR fuel, which involves the removal of the graphite matrix from the fuel, produces a spent fuel in the form of TRISO-coated particles. These spent fuel particles are fully compatible with repository packaging and storage requirements. GA believes that the continued development of the spent fuel treatment processes are important to the overall HTGR effort and recommend continued government support for this activity including support for the U.S./Federal Republic of Germany cooperative spent fuel treatment program at a level of $3 million in FY'86.

SUMMARY AND RECOMMENDATIONS

In summary, Madame Chairman, GA Technologies recommends that your Subcommittee authorize the following for FY-86:

1. A funding level of $36 million (including $1 million for capital equipment) for the HTGR program with primary emphasis on the initial phases of a LTT project.

2. A funding level of $3 million for the Thorium Recycle program with primary emphasis on spent fuel volume reduction.

Thank you for the opportunity to present GA's views before your Subcommittee.

Ms. Lloyd. Thank you, and the staff thanks you as well.

Dr. Wolfe, I think you're going to be with us, you and I are going to be here all afternoon. We're glad you're with us. It's your turn again.

STATEMENT OF DR. BERTRAM WOLFE, GENERAL ELECTRIC CO.

Dr. Wolfe. Ms. Lloyd, I appreciate the opportunity.

Ms. Lloyd. You're our star witness today.

Dr. Wolfe. For some 10 years we at General Electric——

Ms. Lloyd. I am not taking away from the other witnesses. I didn't mean it that way. I'm going to get in trouble. [Laughter.]

Dr. Wolfe. I appreciate being among all the stars.

I won't go through my biography again, but for the past 10 years General Electric has been working on the HTGR with the objective of trying to take advantage of its high-temperature capabilities. It's clearly the only reactor system with the process heat capability of getting temperatures out in the 1,600-degree range, 1,600- to 2,000-degree Fahrenheit range. In addition, we believe it has capability for utility use for electrical generation.

As I indicated before, our objective in all of our development work is to try to make use of the advanced technology to not only improve on reactor performance but to address the institutional problems in the United States with respect to reactor development. The HTGR, as we envision it, has the potential of passive reactor self-protection and thus the elimination of regulatory grade materials or regulated materials in the balance of plant.

It's small and so that we can utilize factory fabrication, it lends itself to the modular concept, and we're talking here about a 100-megawatt electric module—not necessarily a 100-megawatt electric plant; we can have plants from 100 megawatts up to any size by putting these modules together, much as we have put together modules of gas turbine plants as much as 2,000 megawatts in 80-megawatt chunks, 100-megawatt chunks as we're doing in Japan.

And we believe that we can develop a reactor of this size with a cost that can be afforded, not the multibillion-dollar developing cost that we, as I indicated before, attempted with the Clinch River type of development program, because of the small size of the HTGR.

The size of the HTGR, the modular reactor that we propose, much like the modular liquid metal reactor I will talk about on the next panel, is set primarily by the temperature necessary for shutdown heat removal. In this concept you can remove all active systems and the heat from the reactor is basically dissipated through the reactor and out through the vessel, and this sets the size on the reactor somewhere near the 100-megawatt size.

We favor the side-by-side arrangement for the modular reactor. That is, instead of having one single vessel, we favor the approach that KWV in Germany has, or their subsidiary, GHT, has pioneered, which places the steam generator and the circulator in one module connected side by side to the pebble bed HTGR core. We believe that this has advantages both in terms of maintenance but also in terms of keeping reducing shocks to the major components in the system.

We're very pleased that the HTGR program has been redirected toward this modular approach, and we're pleased with the developing recognition of the need and the value of a licensing and technology test. We think the ability to place a small module, to build it and test it, rebuild it and retest it, is necessary and come out with a design which is very close—which is in fact, in essence, the commercial design is the real advantage of this modular approach, and it's one that I think will favor or perhaps give the United States an advantage as compared to the kind of approaches that, for example, are being utilized abroad on the LMFBR program.

We do believe that it's necessary for such a test, that the module that we have to do the licensing test and demonstration test before this concept can be commercialized. We have to do it in order to get the licensing approval of the NRC, and we would propose, as previous speakers have indicated, that we do that through the test rather than through paper, which is then modified as experience comes forth.

We are concerned over the lack of a definitive approach for the HTGR assessment and development in the program as we see it right now. We believe that the environment for the HTGR has reached the point where we should be going on a definitive design program similar to what we're doing in the LMR area to come up with a firm design, which is the basis of the U.S. program, and a firm design for the licensing and safety test program for the demonstration test program. And so we would like to see the program go from the diverse investigations that we are working on now to a more definitive project approach.

We are working, as Harry mentioned, with Bechtel and Combustion Engineering under the aegis of the Gas-Cooled Reactor Associates and Southern California Edison, looking at the side-by-side approach of the KWV GHT organizations to see if that should be the main line of approach for the United States. We, based on a preliminary work, believe it should, and we believe that we should increase the cooperation with the Federal Republic of Germany.

We have licensing arrangements in the light water program with KWV, and we have reached agreements with them, with their subsidiary, GHT, for exchange of technology for the side-by-side arrangements. We've made that technology available to our partners Combustion and Bechtel on this assessment, and we would propose that the Department of Energy, the United States in general, strengthen those ties with the Federal Republic of Germany in order to take advantage of their experience and to avoid unnecessary duplication of costs for both programs.

Based upon our discussions in Germany with the parties involved with the German programs, both their laboratory, their national laboratory at Uhlich and KWV and others, we think that there is a very high probability that we could come up with reasonable arrangements beneficial to both parties.

Again I want to emphasize that we are very pleased with the progress made to date and the support certainly from this committee. We think there is a large amount of work to be done, but we are hopeful that if the program can be focused, that in the next few years we can come up with a definitive test and licensing program that will indeed lead to the deployment of this kind of a reactor in the 1990's for use for both process heat, hopefully, and for utility usage.

Thank you, Madam Chairman and committee members.

Ms. **Lloyd**. Thank you very much, Dr. Wolfe. You timed that just right. You're getting a lot of experience around here. I am very impressed with your team as well.

Mr. Chernock, it's your turn. Please proceed with your testimony.

STATEMENT OF WARREN P. CHERNOCK, VICE PRESIDENT, RESEARCH AND DEVELOPMENT, NUCLEAR POWER SYSTEMS, COMBUSTION ENGINEERING, INC.

Mr. **Chernock**. Madam Chairman, I am Warren Chernock, vice president of research and development, nuclear power systems, Combustion Engineering.

I am pleased to have this opportunity to comment on the modular high-temperature gas-cooled reactor program. I prepared written testimony, and I request that it be made part of the record.

Ms. **Lloyd**. Without objection, your complete testimony is part of the record.

Mr. **Chernock**. Sixteen months ago your committee had the foresight to recognize the potential of the modular HTGR concept. We at Combustion Engineering believe that it is strongly in the national interest to continue to develop the modular HTGR, both for its eventual application for process heat and cogeneration and, on a shorter time scale, to provide for nuclear-powered electricity generation.

You should recognize, Madam Chairman, that Combustion Engineering has not traditionally been a major participant in federally sponsored research, development, and demonstration programs. Our nuclear activities have been confined largely to our commercial and utility customers. Combustion Engineering's research and development has been, for the most part, internally funded through earnings and investments from our corporate treasury. We have supported Federal programs, but have not sought major Federal funding.

Nevertheless, our System 80 design represents the world's most advanced LWR. CE-designed pressurized water reactors have led the United States in nuclear steam supply system availability and plant capacity factor on an integrated basis from January 1976 to the present day.

In addition, we manufacture about 85 percent of an NSSS, which is the highest manufacturing content of any U.S. supplier.

This record of experience is cited here to provide a background for the viability of the comments and recommendations I am about to make.

Madam Chairman, your committee and this Nation deserve more than continued generation of paper studies and generic research and development programs in search of a success path to the modular HTGR. It is time that we fish or cut bait.

It is time that we direct program planning to answer the following question: "What would I as a utility executive need to convince me that purchase of a modular HTGR represents a sound decision?" It is my opinion that a utility decisionmaker will not accept the advantages of the modular HTGR concept unless these advantages are clearly identified by a safety and technology test, described more completely in my submitted written testimony.

This test is vital to this program to serve as a full-scale licensing model incorporating the principle of licensing by test. It is also my opinion that title I design of this full-scale safety and technology test model can and should be initiated in midfiscal year 1985. Such action will focus the program and provide a basis for determining whether we can achieve the advantages we expect.

In years of Government budget restraints, we cannot afford the luxury of individual pursuits. Thus, we believe that it is in the Nation's interest for HTGR participants to concentrate and pool their efforts toward a common target—the title I design—not later, but now.

From our perspective, the U.S. HTGR program has over the years experienced a lack of purpose and focus. It needs a definable project to focus the program and serve as an organizing and scheduling vehicle and to provide a basis for bringing together the mix of strengths that the U.S. nuclear community possesses.

The bulk of the U.S. HTGR technology has been developed by GA Technologies, who have a longstanding relationship with Oak Ridge. GA Technologies also has a strong link to HTGR technology in the Federal Republic of Germany where the AVR has operated successfully for 17 years and a 300-megawatt electric pebble-bed-fueled HTGR has completed low-power testing.

The second vital element in carrying out a nuclear project is engineering and project management skills. Should there be an expression of will from Congress that the HTGR program with emphasis on the design, construction, and testing of a safety and technology test module go forward, Combustion Engineering would be willing to apply to this effort its demonstrated excellence in designing and project management of nuclear systems.

The Combustion Engineering record for engineering excellence in project and systems management—and, yes, business success in nuclear power—is well known. Most importantly, despite the turn-down in new equipment orders over the past 10 years, we remain an NSSS supplier.

If we are indeed going to build a safety and technology test module, we believe it is necessary to establish a single entity with clear-cut authority and responsibility to do the job. This is a different kind of organizational structure than currently exists on the HTGR program. Demonstrated successful industrial experience in project management, systems engineering and execution of major projects is essential, in contrast to the institutional arrangements appropriate for an R&D program.

Thus, we recommend the formation of a new organization, which I refer to as the "HTGR Supply Co." The characteristics of such an organization are detailed in the submitted written testimony. We believe that such a single-purposed and -focused organization, for which precedents exists, can best maintain the momentum of the program and utilize to the full extent the capabilities of willing and qualified participants.

In conclusion, Madam Chairman, let me reiterate Combustion Engineering's support for the modular HTGR program and Combustion Engineering's willingness to apply its demonstrated excellence in engineering design and project and systems management to this program.

We believe that the time has arrived to proceed in fiscal year 1985 with the initiation of title I design for the construction and testing of a safety and technology test module, with the aim of licensing by test and providing confidence to a utility decisionmaker that a modular HTGR is a viable choice.

It is our recommendation that a single-purpose enterprise be established with the responsibility and authority to design, construct, and supervise testing of the safety and technology test module.

I would like to thank you for the opportunity to comment, and I would like to join Mr. Dance in expressing my appreciation to your most competent staff and their excellent work in organizing this hearing.

[The prepared statement of Mr. Chernock follows:]

STATEMENT SUBMITTED TO
SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION
COMMITTEE ON SCIENCE AND TECHNOLOGY
UNITED STATES HOUSE OF REPRESENTATIVES

FY 1986 DOE AUTHORIZATION
HIGH-TEMPERATURE GAS-COOLED REACTOR PROGRAM

Warren P. Chernock
Vice-President, Research and Development
Nuclear Power Systems
Combustion Engineering, Inc.
February 18, 1985

Madame Chairman, my name is Warren P. Chernock. I am Vice-President for Research and Development, Nuclear Power Systems, Combustion Engineering, Inc. I am pleased to have this opportunity to comment on the Modular High-Temperature Gas-Cooled Reactor Program, with particular reference to the proposed program for Fiscal Year 1986. I have taken the liberty of commenting also on program acceleration in Fiscal Year 1985 to include the initiation of Title I Design.

INTRODUCTION

Light water reactors are in operation; more are being built. The public concern over nuclear safety is a matter of perception, not reality. Light water reactor technology has achieved an admirable, if not unprecedented, record of safety in the 23 years that commercial nuclear plants have been in operation.

The modular HTGR would provide a smaller unit size, shorter construction schedule and reduced financial commitment. These characteristics would permit utilities and public utility commissions to follow changes in load growth more adequately. Coupled with the inherent safety characteristics of the modular HTGR and the ability to provide the high temperatures necessary for entering new non-electric markets, these features argue strongly for a timely introduction of this concept in the U.S.

Combustion Engineering has been interested in the HTGR for many years, and since 1981 has been an active participant in the on-going DOE program. Our interest comes from the recognition that this reactor type has the potential for extending the benefits of nuclear power to the two-thirds of the nation's energy consumption which is not in the form of electricity; in particular, that which is used for transportation and industrial processes.

Sixteen months ago, this Committee had the foresight to recognize that the ability of the ceramic fuel particles to retain fission products at a very high temperature and the ability of a sufficiently small reactor to dissipate all its decay heat by the fundamental processes of radiation and conduction, without depending on the retention and circulation of coolant, represented inherent safety characteristics of the modular HTGR.

We support this view, and believe that it is strongly in the national interest to continue to develop the modular HTGR both for its eventual application for process heat and cogeneration purposes and, on a shorter time scale, to provide means for nuclear powered electricity generation.

It would not be realistic, however, to assume that these important objectives will stimulate the private sector to proceed alone with the development and commercialization of a modular HTGR. Program planning must be guided by an answer to the following question: "What would I, as a utility executive, need to convince me that purchase of a modular HTGR represents a sound decision?"

It is my opinion that a utility decision maker will not accept the advantages of the modular HTGR concept unless such advantages are clearly identified via a Safety and Technology Test (STT). I believe that this test is a vital element in the HTGR program. Without this test, which we envision would serve as a full-scale licensing model, all of the calculations, innovative paper designs and laboratory scale model tests will merely provide more reports which will be of scientific and engineering interest but will not achieve the end objective of answering the gnawing question which faces a utility decision maker.

Madame Chairman, your Committee, which has been a strong supporter of the HTGR for many years, and this Nation deserve more than continued generation of paper studies and generic research and development programs in search of a success path to the modular HTGR. It is time that we "fish or cut bait." Commitment in Fiscal Year 1985 to a Title I Design will focus the program and flush out all the facts and provide a basis for determining whether our technology, calculations, innovative designs, test results and laws of nature combine to provide the advantages we all believe can be achieved.

However, we cannot afford the luxury of individual pursuits or multiple programs. It is vital that all participants concentrate and pool their efforts toward a consensus Title I Design and that this effort be aimed at a Safety and Technology Test which would form a basis for "licensing by test" rather than licensing by calculation.

RECOMMENDED PROGRAM

During the past year, the Department of Energy has carried out a systematic and detailed evaluation of the best way to achieve the objectives of the DOE program. A steel-vessel modular reactor, using pebble fuel of the type proven by 17 years of highly successful operation of the German test reactor, AVR, and capable of generating 100 MWe, has been chosen. The stage has now been set to proceed with Preliminary Design (Title I), so that the NRC can join in a definitive assessment of the safety characteristics and licensing requirements for such a reactor, and so that DOE can lay before Congress a year from now an appropriately documented construction project. We would resist the temptation to revisit the decisions which have been made during the past year, or to succumb to the search for new concepts of great promise, but requiring significant further investigation and development. Thus, a Title I Design effort could be initiated by mid-Fiscal Year 1985.

We believe that Title I can be initiated using the extensive technology base already established, thanks to the steady support of this Committee and the diligent work of the DOE and its contractors. The only significant exception is the need to obtain further detailed information on the release of fission products from highly irradiated fuel heated to 1600-1800°C. With this in mind and with the utilization of Oak Ridge National Laboratory to obtain such fuel performance information, it should be possible to proceed expeditiously.

The program we recommend, which I will refer to as the Safety and Technology Test (STT), would entail the design, construction and testing of a single full-scale nuclear steam supply system. The objectives would be:

1. To demonstrate by actual test that a modular HTGR will impose no hazard to the public, even though all coolant is lost and no active safety systems operate;
2. To define licensing requirements precisely and to obtain a standard license from the NRC for replicates of the NSSS;
3. To demonstrate to future customers the performance, reliability and investment and protection of the modular HTGR so that a utility decision maker will have a basis upon which to make a decision; and
4. To provide a cost and performance data point so that suppliers can proceed with commercial offerings on a practical basis.

This test would be a Government project, but the test article would have to meet the requirements of the utility users and of the suppliers. The successful conclusion of the test program would inaugurate the commercial sale of the HTGR. Further large-scale Government support would not be needed.

Since the tests envisioned would be non-destructive, the test article could potentially be sold to a utility for continued operation as a power reactor. With this in mind, it seems likely that a utility or a group of utilities would provide some features for the test facility (e.g., a turbine-generator) to facilitate such eventual use.

Some supplier-participants in the current program have expressed a willingness to share in the costs in the program. For our part, we at Combustion Engineering are willing to share in the costs of fabrication of components such as vessels and steam generators assigned to us.

HTGR SUPPLY COMPANY

To carry out the kind of aggressive, dynamic program which is needed will require a different kind of organizational structure than currently exists on this program. Industrial experience in project management, systems engineering, and execution of major construction projects is essential, in contrast to the institutional arrangements appropriate for an R&D program.

If we are indeed going to build a Safety and Technology Test module, it is necessary to establish a single entity with clear-cut authority and responsibility to do the job, capable of making dynamic, positive timely decisions on the technical level and performing top level project management and systems engineering functions. Thus, we recommend the formation of a new organization, which I will refer to as the HTGR Supply Company. It would have the following characteristics:

1. A single-purpose enterprise for the Safety and Technology Test;
2. Open to all interested and qualified participants;

3. Provide effective project management, prompt and competent decision-making, and clear-cut lines of authority and accountability;
4. Turnkey responsibility as prime contractor for the STT;
5. Sub-contract defined tasks such as design, fabrication, and construction;
6. Define needs and sub-contract for additional development and testing;
7. Provide for incorporation of technology being developed in the Federal Republic of Germany to the extent this information can be made available;
8. Provide for competition on subsequent commercial projects through shared access to new design information and technology;
9. Personnel seconded from all participants, but owing primary allegience to the HTGR Supply Company for the duration of their assignments; and
10. Utilization of Oak Ridge National Laboratory as the lead DOE Laboratory to provide technology specifically required for the Safety and Technology Test. At this time, this effort is envisioned as performance of irradiation tests on pebble-bed fuel in the temperature range of 1600-1800°C.

We believe that such an organization (for which precedents exist) can best maintain the momentum of the program, utilize to the full extent the capabilities of all current participants, and facilitate a competitive commercial industry when market growth justifies it.

CONCLUSION

In conclusion, Madame Chairman, let me reiterate Combustion Engineering's support for the modular HTGR program.

We believe that the time has arrived to proceed, in Fiscal Year 1985, with the initiation of a Title I Design aimed at the construction and testing of a Safety and Technology Test with the aim of "licensing by test" and providing confidence to a utility decision maker that a modular HTGR is a viable choice.

It is our recommendation that a single-purpose enterprise, open to all interested and qualified participants, be established with the responsibility and authority to design, construct and supervise testing of the Safety and Technology Test Module.

Thank you for the opportunity to comment.

Ms. LLOYD. Well, thank you very much, Mr. Chernock. We always appreciate having you with us.

Mr. Levenson, we look forward to your testimony.

STATEMENT OF MILTON LEVENSON, EXECUTIVE ENGINEER, BECHTEL POWER CORP.

Mr. LEVENSON. Thank you, Madam Chairman. I am Milton Levenson, an executive engineer of Bechtel Power Management. Howard Wahl, the vice president, director, and division general manager of our Eastern Power Division, who was planning to testify today, has been called away for an essential meeting at our San Francisco office, and he has designated me to represent him at these hearings.

Bechtel is not a reactor vendor, but as a company we have been involved in the development of nuclear power from its inception. We were involved in EBR-1, which produced the first electricity from nuclear power; in Peach Bottom-1, a prototype HTGR; in Dresden-1, which some people identify as the first commercial BWR but it in any case was a milestone; and in the engineering or construction of more than 80 subsequent commercial nuclear powerplants in the United States and abroad.

We are currently involved in the development of HTGR's as a private sector participant with the utility-sponsored Gas-Coo'led Reactor Associates. After a systematic and careful evaluation of 16 different candidates, the HTGR program participants selected the steel vessel multimodule HTGR as the concept possessing the greatest potential for further development and commercialization.

Bechtel is strongly supportive of this decision. As we understand the present program, the effort during the remainder of 1985 will focus on design simplification and confirmation of the economic viability of the selected concept. Further effort will be required in 1986 to advance the reference design to the level of detail necessary to support the preparation of a preliminary safety information document. This would be the first step in obtaining confirmation of its licensability through appropriate interaction with the NRC.

If this approach is successful, we should be in a position to organize and embark on a licensing and technology test project by the end of 1986. We are here today to support the viewpoint that the assurance of an adequate long-term supply of electricity is so essential to the stability and well-being of our country that it is most appropriate for Congress to take whatever actions are necessary to ensure the success of that objective. Nuclear power must clearly play a major role in achieving that objective.

Light water reactors are the base on which the United States has developed its nuclear technology, and the rest of the world has confirmed that choice. Light water reactors have proven to be safe and reliable as large central electricity generating stations and, as demonstrated by many operating plants, the technology has also proven to be economical.

As the role of nuclear power expands, there will be a role for types of plants other than light water reactors, and we believe that the modular HTGR has the potential to be one of those additional concepts. Therefore, we support the proposed budget authorization for the DOE HTGR program.

I will briefly outline our view of the HTGR and its complementary position in relation to other nuclear technologies. We do not consider the HTGR to be in direct competition with either the light water reactors or liquid metal reactors. The HTGR has characteristics different than either the light water reactor or the liquid metal reactor and therefore has the potential to be a useful addition to our country's nuclear energy options.

Because of its demonstrated high-temperature operation, this could include energy uses currently not provided by either light water reactors or liquid metal reactors. Each of these three reactor types uses our nuclear resources in a different way, and in combination they would maximize the Nation's benefits from the available uranium reserves, an objective that will become ever more important as we enter the 21st century.

The HTGR has the potential to complement the baseload light water reactor in several ways. First among these is its unique ability to provide in the long term a significant source of high-temperature industrial process heat. Second may be its ability to repower existing small- and medium-size fossil powerplants. By repower, we mean replace an existing boiler that has deteriorated or replace a coal boiler whose operation cannot be continued because of environmental constraints.

As we enter the next century, the shortage of powerplant sites will probably dictate that we do not—that we do not—routinely decommission powerplants, but that whenever possible we refurbish them.

Third, if the regulatory process addresses inherent differences due to reactor size and reactor design as a basis for siting, small HTGR's may be viable candidates for cogeneration facilities providing process steam and electricity. In the small-size plants, preliminary analysis and tests demonstrate that the decay heat can be safely accommodated by core heat capacity plus passive cooling features and that so-called core events progress very slowly.

In the same context, the modular HTGR may be a prime candidate for utilities or countries where electrical systems or growth rates require smaller increments of capacity than that available from current light water reactors.

HTGR development has been underway for over 25 years. Bechtel is proud of having built the world's first HTGR powerplant on a utility grid, the 40-megawatt Peach Bottom-1 for Philadelphia Electric Co. That project, supported by 52 utilities, validated the basic concept of a graphite matrix core for a nuclear powerplant.

In a parallel effort, the concept of pebble bed fuel has been demonstrated by 17 years of operation of the West German AVR. That plant has also demonstrated online refueling and continuous high-temperature operation.

From the viewpoint of an engineering and construction company, we perceive no particular problems in the design and construction of a modular HTGR whether fueled by pebble bed or matrix fuel.

In summary, we believe that the HTGR has the potential to be an important component of our Nation's future energy mix. Since the development of a new energy source and technology is a multi-decade process, and since the beneficiary of such developments is society as a whole, we believe that it is appropriate that the Government include support for this effort in its energy planning.

Thank you, Madam Chairman.

[The prepared statement of Mr. Levenson follows:]

STATEMENT SUBMITTED TO
SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION
COMMITTEE OF SCIENCE AND TECHNOLOGY
UNITED STATES HOUSE OF REPRESENTATIVES

FY 1986 DOE AUTHORIZATION
HIGH-TEMPERATURE GAS REACTOR PROGRAM

MILTON LEVENSON
EXECUTIVE ENGINEER
BECHTEL POWER CORPORATION

FEBRUARY 21, 1985

I am Milton Levenson, Executive Engineer of Bechtel Power Management. Howard Wahl, Vice President, Director and Division General Manager for the Eastern Power Division of Bechtel Power Corporation has a very important commitment at our San Francisco Home Office today. He has designated me to represent him at these hearings. Bechtel has been involved in the development of nuclear power from its inception. We were involved in EBRI, which produced the first electricity from nuclear power; in Peach Bottom I, a prototype HTGR; in Dresden I, a milestone Boiling Water Reactor; and in the engineering or construction of more than 80 subsequent commercial nuclear power plants in the U.S. and abroad.

We are currently involved in the development of HTGR's as a private sector participant with the utility sponsored Gas Cooled Reactor Associates - GCRA. We are here today to support the viewpoint that the assurance of an adequate long term supply of electricity is so essential to the stability and well-being of our country that it is appropriate for Congress to take whatever actions are necessary to insure the success of that objective. Nuclear power must clearly play a major role in achieving that objective. Light water reactors (LWR's) are the base on which the U.S. has developed its nuclear technology and the rest of the world has confirmed that choice. LWRs have proven to be safe and reliable as large central electricity generating stations. As demonstrated by our operating plants, the LWR technology has also proven to be economical. As the role of nuclear power expands there will be a role for types of plants other than LWR's. We believe that the Modular Pebble Bed HTGR has the potential to be one of those additional concepts and therefore we support the proposed budget authorization for the Department of Energy HTGR program.

I will briefly outline our view of the HTGR and its complementary position in relation to other nuclear technologies. We do not consider that the HTGR is in direct competition with either the light water reactors (LWR) or the liquid metal reactors (LMR). The HTGR has characteristics different than the LWR or LMR and therefore has the potential to be a useful addition to our country's nuclear energy options. Because of its demonstrated high temperature operation this could include energy uses currently not provided by LWR's or LMR's. Each of the three reactor types uses our nuclear resources in a different way and in combination they would maximize the nation's benefits from the available uranium reserves, an objective that will become ever more important as we enter the twenty first century.

The HTGR has the potential to complement the base load LWR in several ways. First among these is its unique ability to provide in the long term a significant source of high-temperature industrial process heat. Secondly may be its ability to repower existing small and medium size fossil power plants. By repower we mean replace an existing boiler that has deteriorated or replace a coal boiler whose operation cannot be continued because of environmental constraints. As we enter the next century the shortage of power plant sites will probably dictate that we do not routinely decommission power plants but that wherever possible we refurbish them. Thirdly, if the regulatory process addresses inherrent differences due to reactor size and reactor design as a basis for siting, small HTGRs may be viable candidates for co-generation facilities providing process steam and electricity. In small size plants preliminary analyses and tests demonstrate that the decay heat can be safely accommodated by core heat capacity plus passive cooling features and that "core events" progress very slowly. In this same context, the modular HTGR may be a prime candidate for utilities or countries where electrical systems or growth rates require smaller increments of capacity than that available from current LWRs.

HTGR development has been under way for over 25 years. Bechtel is proud of having built the world's first HTGR power plant on a utility grid--the 40 MWe Peach Bottom I for the Philadelphia Electric Company. That project supported by 52 utilities validated the basic concept of a graphite matrix fuel for a nuclear power plant.

In a parallel effort the concept of pebble bed fuel has been demonstrated by the 17 years of operation of the West German AVR. That 15 MWe plant has also demonstrated the practicality of on-line refueling and continued high temperature operation.

From the viewpoint of an engineering and construction company, we perceive no particular problem in the design and construction of a modular HTGR whether fueled by pebble bed or matrix fuel.

In summary we believe that the HTGR has the potential to be an important component of our nation's future energy mix. Since the development of a new energy source and technology is a multi-decade process, and since the beneficiary of such developments is society as a whole, we believe it is appropriate that the government include support for this effort in its overall energy planning.

Ms. Lloyd. Thank you very much, Mr. Levenson. I understand that you might have a plane to catch. Do you have any time or do you need to move on?

Mr. Levenson. I would like to catch a plane.

Ms. Lloyd. Feel free to catch your plane at this time. We thank you for being here.

Mr. Levenson. I can stay another couple of minutes if there are a couple of questions, yes.

Ms. Lloyd. One question. You represent the world's largest construction company; is that right?

Mr. Levenson. Like reactors, there are many ways of rating it. We consider ourselves very large.

Ms. Lloyd. Well, how would you suggest that this program be moved ahead so that we can get the maximum benefits from the Federal Government's investment?

Mr. Levenson. I think it's somewhat like the discussion earlier on the licensing process. And that is the matter of predictability. If you're interested in getting private companies to make commitments either to participate, to provide funds, to take responsibility, there must be some assurance that in fact the project is going to go ahead, that it's going to be under realistic, practical direction so that the output of the project can be almost directly used by industry. That has been a very serious problem many times in the past with Government-sponsored research, because the objectives tend to be somewhat different.

I think that there comes a time when you have to stop studying alternatives. If we had applied what we do in the nuclear business to transportation, we'd still be discussing oxcarts versus camels versus horses and would never have gotten to the automobile.

We need to have a mechanism where somebody says, "This week we are going to make decisions. We've studied enough things. What needs to be done to make this option proceed?" It doesn't have to be the best option; it only has to be good enough. And I think we have a couple that are good enough, and until or unless we decide, "Yes, we want that one," it won't come into being.

Ms. Lloyd. I thank you for that perspective. It seems to me that this committee's charge is to develop the products that can go to the marketplace, and I am a little bit concerned that the demise of Clinch River, as we move to other technologies, didn't come to the marketplace sooner, that we must move rapidly ahead, that we must go ahead with the demonstration projects, because indeed the Congress and those that are opposed to nuclear power—and certainly that is their right—but so be it, there are those in the Congress that are opposed to the funding that's going to our nuclear R&D. And if we really want to get a commitment out of this Congress, we are going to have to come with something in our hands. The time has come that we must demonstrate what we've been doing with our dollars, Federal dollars as well as private sector dollars.

Mr. Levenson. I think you know, Madam Chairman, that I spent some 37 years of my career in research in the national laboratories and elsewhere, and studying things is a lot of fun, but it doesn't achieve serious commercial objectives.

Ms. **Lloyd**. Well, programs, as opposed to basic research, need to be based on objectives that are to be achieved by a time certain, which is the point that I was trying to make.

Mr. **Levenson**. Yes. I think I don't want to get confused——

Ms. **Lloyd**. If I could get you to elaborate on that.

Mr. **Levenson**. I don't want to confuse basic research and engineering studies. They're always essential. But when you reach—when you're talking about engineering concepts, then a certain amount of study is done and then you have to decide to go ahead. And if you decide to not make a decision and go ahead, then that's a specific decision you're making to not go ahead.

Ms. **Lloyd**. Thank you very much, and I hope you catch your plane.

Mr. **Levenson**. Thank you.

Ms. **Lloyd**. It seems that the administration is against going ahead with our demonstration projects. They seem to feel that the private sector can solve the energy supply problem. But given the recent history of our nuclear projects, it seems that this policy is getting rather critical and that it is a little risky for investors to go on their own.

It takes a long time, as all of you know, to develop a new reactor, and if you wait until we actually need them, we're not going to have the time to develop it unless we want to go back with old technologies or stay with coal-fired plants.

So, Dr. Wolfe, as a business executive, would you recommend to your board of directors that GE finance the R&D and the fabrication and the on-site installation and the testing of a modular HTGR test?

Dr. **Wolfe**. No.

Ms. **Lloyd**. OK.

Dr. **Wolfe**. Mrs. Lloyd, as I have tried to indicate my view that these programs, I think we have good programs and that they have a very good chance for success at returning the United States to a leadership position and in giving the United States the assurance of a power supply into the next century. So I don't want to denigrate our own efforts, which I believe in, but I do want to point out that the problem that we're in is a problem that's been caused by the Federal Government and for the Federal Government to stand aside and say, "It's not our problem, it's Bechtel's or General Electric's or Combustion Engineering's," seems to me misses the whole point.

We have put in our hundreds of millions of dollars, General Electric has, in developing the nuclear option in this country. It's been turned around or it's been brought to the present state, in my view, because the Federal Government has not responsively discharged its real responsibilities which I believe it has in the area of public safety and foreign policy. It hasn't discharged those responsibilities in a way which protected and tried to nourish the enterprise which has been set up according to congressional law; namely, to make sure that nuclear power is brought out for the benefit of the public.

I don't believe that anybody can predict based on the past experience the future policy of this Government. I hate to say that, but I think that even I would doubt that the members of this committee would be willing to give me a guarantee today that the policy that might be outlined today will be the same policy 5 years later. To give a parallel, for example--after the Barnwell plant was put up with $250 million to $300 million, I don't remember, and then the policy changed, and they weren't even allowed to operate it.

Nobody can give assurance that that won't happen again, and under those conditions it seems to me nobody, no responsible business person, can talk about significant investments in an endeavor over which he has no control and which in the past we've demonstrated the Federal Government can change essentially on whims or on elections.

So I would have to say that I believe, as I think Milt Levenson said, this is a responsibility of the Federal Government and it's one which I—and I have been in the nuclear business my whole career—I believe it's going to be essential to the welfare of this country, I believe it's going to be essential to the welfare of the world.

I believe we're not going to have a stable world in the next century for our children unless nuclear power goes forward and we develop the supply that the whole world can use, including the underdeveloped nations. So let me make that point, that personal point clear.

But as a businessman, I really could not propose to my company that we invest substantial fundings in these programs.

Ms. Lloyd. You don't sound like you'd buy a used car from the Federal Government, Dr. Wolfe. [Laughter.]

Dr. Dance.

Dr. Dance. I second what Bert said. I just want to put on the record, though, there is no question I think from GA's standpoint—and, I suspect, from GE's, Combustion's, Bechtel's—that if we go forward and we build this test facility and we get some of the institutional things and some of the things that the Government controls, licensing and so forth that we in the private sector can't control all the way—we're not asking for a dole once it comes to commercial reality—if we get this thing done, if it works, we're all willing to step up, we're willing to take real risks if things that are in some control, some ability to predict.

So it should be on the record that we do not expect Federal money to go forever in this program, because, as I think Bert said, there is the next step. And quite frankly, we've all made our hundreds of millions of dollars of investment and we can't be doing it again without some degree of certainty.

Ms. Lloyd. Is there general agreement among you to design a concept, Mr. Walker?

Mr. Walker. I am in the buying end rather than selling end, so——

[Laughter.]

Mr. Walker [continuing]. But let me just comment briefly. I can sympathize with GE's and GA's, and I am sure, Combustion's position here that they have invested a lot of money in the concept, but I do appreciate what Dr. Dance said. If we would get this module, this test thing done and get the thing truly licensed so that we could have some reasonable assurance, I think from the utility side then we'd be willing to give one of these gentlemen an order, which would be a lot of our risk but we would expect a little risk from them, too, as far as its ability to operate and that sort of thing.

Ms. LLOYD. Thank you.

Mr. WALKER. So it's very important that we get these institutional things straightened out so we can both go forward.

Ms. LLOYD. Thank you.

Mr. CHERNOCK. I don't want to sound irresponsible, but I do want to make a statement that does appear in our written testimony, and that is with respect to the safety and technology test. We at Combustion are prepared at a particular milestone in the program to cost share with respect to component fabrication.

And I agree with Bert with respect to some of the past histories, and it is for that reason that we would at least like to see a milestone established in the program before cost share is involved. So that that is our position, and it is in our written testimony.

Ms. LLOYD. Well, thank you very much.

Mr. Fawell.

Mr. FAWELL. Just one question. I am sitting here learning an awful lot. But, Mr. Wolfe, if you were—there's a lack of leadership, I think you implied—if you were the director of the Department of Energy and you had your druthers and you had a free hand, what guidelines and directives then—how would you turn it around and go at it the right way?

[Laughter.]

Dr. WOLFE. I would come to you——

[Laughter.]

Dr. WOLFE [continuing]. Because I think the key is in the Congress, and I will say that I think the start of the downturn in nuclear power came when the joint committee was disbanded and we lost the focal point in Congress. I think this committee happens to be one of the few committees—the few places, excuse me—one of the few places in the Congress where we have a focal point that's been continuous for years and has a policy and an approach that is consistent. But we've lost that in the Congress.

At any rate, it seems to me that what's required is for the Federal Government to clearly develop an energy policy and plan with respect to nuclear power, much as I understand it the Congress dictated in the original Atomic Energy Act of 1954, which again as I understand it is still in force. And at the present time, this requires, in my view, first an attack on the institutional problems. And I would make that a part of the Federal program. I am not sure it's really part of the Department of Energy role. I am pleased to see that NRC has made some approaches to Congress with respect to changing their charter and regulations. So I think that's the first thing.

Second, with respect to these programs that we're talking here, it seems to me that the Department of Energy should clearly state as an objective the development of these types of advanced concepts to the point where they are demonstrated and that the utilities then are able to make an informed judgment on the characteristics of these plants and decide and have enough information to make the commitment to purchase them if the development programs are successful.

Those are generalities, and they represent lots of interaction with the Congress, but I do believe that it's going to take a congressional mandate to get this program back on the tracks and leadership from the Department of Energy.

And I have got to say as I said before, I think that the Federal Government has to exercise some leadership and it can't be in a bystander position waiting for the private enterprise system to come to its rescue. I think the Federal Government, as I said—this isn't a private enterprise industry, as indicated by past Federal and State regulation.

I want to say, just to make it clear, those are my private personal opinions. There may be people in General Electric—I suspect there are—who would disagree with me. So let me answer that question, Mr. Fawell, as a person who's been in the nuclear business for some quarter century and not as a representative of General Electric per se.

Mr. **Fawell**. One of the first problems that an executive does find that he does have. [Laughter.]

Thank you very much.

Ms. **Lloyd**. Mr. Stallings.

Mr. **Stallings**. Mr. Walker.

Mr. **Walker**. Yes, sir.

Mr. **Stallings**. If the Federal Government were to fund the research and development necessary to fabricate a full-scale test article, not a power-producing plant but a nuclear steam supply system, and had that test article accepted by the Nuclear Regulatory Commission based on its merits, how might that help the utilities and the ratepayers, assuming, of course, that the tests were successful?

Mr. **Walker**. You're talking of the 100-megawatt test demonstration facility that we would use to actually prove that this was licensable and that it did have the heat cooling capacities and all that sort of thing, which would be quite a program and you'd have to try many things that you wouldn't do on a commercial unit in order to come up with that licensability, so to speak.

There are two parts to your question. I think the first would be, during that test phase you would want that to be a complete test, that you had the nuclear steam supply system so that you did make steam. And it would only make sense that that steam be used to generate electricity. It could be a new facility. There might be a place in the country where it could be repowered to an existing turbine generator. That energy would certainly be valuable to the utility that did it during the testing, but you'd have to recognize that that was a test facility and the energy wouldn't necessarily be baseload or firm.

That would be of value. Now, going on, if that is successful and the utility would order one of these then, and of course, if you would have the advantages of it being, in effect, prelicensed, which means it could be fabricated in the shop, put on, and you could shorten the construction time, there's a good chance that the economics then would prove out satisfactorily and it could compete.

As it's been said before this afternoon, it does have to compete with the other alternative we had, and if it did, then it would inure to the benefit of our ratepayers and to our shareholders also.

Mr. STALLINGS. Thank you.

Ms. LLOYD. Thank you very much, Mr. Stallings.

Those of you who have been attending these committee hearings even before I became a member of this body, I think appreciate the fact I think we do have a good working group and the new committee, and I think it will work hard and do as Dr. Wolfe has said, really take a big interest in moving ahead. And I like to see the enthusiasm that's been generated so far by this subcommittee.

It gives me pleasure now to turn the gavel over to Mr. Richard Stallings—he's from the Second District of Idaho—who will chair the duration of this hearing.

Mr. Stallings is a history professor from Ricks College in Idaho and has degrees from Webber State College and Utah State University. He does have a very keen interest in nuclear fission R&D activities at Idaho National Engineering Laboratory, and I am delighted to have him a member of the new committee.

The committee is yours, and I do thank you.

Mr. STALLINGS [presiding]. Could the liquid metal reactor program witnesses please come to the table?

[Pause.]

I believe we will begin with the testimony of Dr. Arnold. Did you want to begin, sir?

STATEMENT OF DR. W. HOWARD ARNOLD, GENERAL MANAGER, ADVANCED ENERGY SYSTEMS DIVISION, WESTINGHOUSE ELECTRIC

Dr. ARNOLD. I am Howard Arnold, general manager of the Advanced Energy Systems Division of Westinghouse Electric. I am responsible for our liquid metal reactor research, fuel cells, photovoltaics, and other emerging energy technologies as well as advanced nuclear service equipment such as that to be used in TMI-2 for defueling, as was reflectd in Mr. Kintner's prepared testimony.

I submitted a statement for the record, which I will abbreviate drastically.

What is needed in the nuclear field is a reliable and predictable cost that is clearly competitive with alternative power sources. Reactors of our design are being built in other countries, particularly France and Japan, for costs and on schedules which would be highly competitive in the United States.

Returning to predictable and competitive costs in the United States will require aggressive action from industry, the Department of Energy, the Nuclear Regulatory Commission, and the Congress.

As you have already heard this afternoon, we have at Westinghouse the roadbed of an advanced light-water reactor design laid carefully, and we will now build on that base in order to prevent our arrival at a deadend in energy options. We believe that nuclear power will have an important role in meeting our needs through much of the next century and that the next step in that technology will be required, and it is the breeder reactor.

Although breeding capability will definitely be required in that future, our near-term development efforts should focus on reduced-cost liquid metal reactors, even if that is at the expense of breeding. To distinguish between a liquid metal reactor and an LMFBR, or breeder, a liquid metal reactor, or LMR, is similar to an LMFBR, but the two have different breeding ratio objectives and fuel cycle implications.

Breeding ratio objectives for LMR's can be less than one. They can be fueled with enriched uranium rather than mixed plutonium uranium, and they are not dependent on fuel cycle closure for deployment. These differences in objectives can enable the LMR to become economically viable before shortages in uranium supply escalate the price of uranium and result in a requirement for closure of the fuel cycle.

We should aim for a cost equivalent to alternative power sources, either nuclear or nonnuclear, to enable deployment and to gain extensive operating experience with the LMR.

The question of nuclear plant size usually enters the discussions at this point. Westinghouse contacts with potential nuclear plant customers indicate at least to us that most have no particular interest in moving toward smaller nuclear plants in the future. In fact, in the low-power range, up to several hundred megawatts electric, we believe that nuclear powerplants will not be competitive with nonnuclear alternatives for a very long time.

We feel that our focus for LMR development should be on plants with capacities of 500 megawatts and upward. If competitive LMR's in this size range can be developed and used in the next few decades, breeder technology will then be readily available in the form of LMFBR's when they are, in turn, needed.

Based on a wealth of component design and testing information from the Clinch River project and the EPRI-led large prototype breeder reactor design and development, a product line can be developed for LMR's from 500 to 1,000 megawatts electric, by varying the number of heat transport trains while using many identical or scalable nuclear steam supply system components.

Our LMR Development Program could be focused to support a competitive product line that does not require construction of an expensive demonstration plant. The U.S. LMR Program can move in the direction of a product line now by emphasizing the following elements in its program: Continued development of inherently safe LMR design approaches that minimize dependence on mechanical and operator actions. We have been a leader in this area and have found several areas of convergence between inherently safe designs and low cost.

Two, development of very long life core designs so that only one or two fuel loadings would be required over the life of the plant. Long core life would improve plant availability, reduce operating costs, and lessen the need for fuel cycle operation such as transportation and reprocessing.

Three, continued development and demonstration of those LMR components such as steam generators that are high in both cost and risk.

Four, development of designs conducive to more extensive factory fabrication, leading to shorter construction schedules and lower costs.

Five, early and continuing interactions with the NRC to establish appropriate licensing bases and resolve generic issues in the early stages in order to minimize licensing delays later.

And six, last but not least, movement toward effective international agreements that could lead to information exchanges from foreign demonstration plant experiences and potential joint involvement in LMR fuel processing. This task would require close cooperation between Government and private industry.

I thank you for this opportunity to testify.

[The prepared statement of Dr. Arnold follows:]

TESTIMONY TO THE
ENERGY RESEARCH & PRODUCTION SUBCOMMITTEE
HOUSE SCIENCE AND TECHNOLOGY COMMITTEE

DR. W. H. ARNOLD

THE REVITALIZATION OF NUCLEAR POWER

I am Dr. Howard Arnold, General Manager of the Advanced Energy Systems Division of the Westinghouse Electric Corporation. I am responsible for our liquid metal research, fuel cells, photovoltaics and other emerging energy technologies.

Westinghouse has over 35 years experience in development and deployment of nuclear power. That experience evolved from the Nautilus submarine reactor through 101 on-line nuclear power plants worldwide, with another 65 under construction by ourselves or our licensees. Development of the Liquid Metal Reactor (LMR), the compact gas reactor for rocket engines (NERVA), the heavy water pressure tube reactor (CVTR), the Fast Flux Test Facility (FFTF), and the Clinch River Breeder Reactor Project (CRBRP) has provided a strong foundation for our activities in the large plant design studies and the Liquid Metal Fast Breeder Reactor (LMFBR) Base Technology Program, ongoing at both the Advanced Energy Systems Division and Westinghouse Hanford Company.

I am pleased to have this opportunity to discuss an issue of crucial inportance to this country's energy future - the revitalization of nuclear power.

We have been reading and hearing that the nuclear option in this country is wanning. Let me assure you today that the nuclear industry is not moribund, anymore than are the fossil fuel power industries. The nuclear industry has reached a slowing of momentum, as have the other domestic power industries. If you check current inventories, you'll find that the overall economic downturn and the slowdown in load growth several years ago have affected all energy sectors. We at Westinghouse see this stage of dormancy in nuclear energy as a chance for creative reflection and an opportunity to refine and revitalize those concepts that have proven successful and that will carry us into and through the next century.

Projected load growth, even using the lower numbers for that growth, and retirement of obsolete power plants will require new plant orders in the United States later in this decade and accelerated orders in the next decade. The utilities' use of any power source, whether nuclear or non-nuclear, has taken a course of identifiable and economically justifiable evolution. We are now in that position of being able to survey the course we've taken and to plan for its direction. Outside the United States, the demand for energy is also increasing, and foreign needs are evident now. We are in a world marketplace for nuclear power, with world-class competition and world-based experience. What we do here, in the United States, will affect not just our ability to provide adequate energy for the public's needs but also our ability to work with, learn from, and participate in international forums.

It has become apparent, through recent source term evaluations, analyses of long-term nuclear operations, and even the "worst case" scenario of TMI, that the risks of nuclear power accidents have been grossly overestimated. In addition, there is a growing awareness that environmental impacts of nuclear power plants compare favorably with other power sources. The effects of acid rain and the concern over a possible greenhouse effect have no counterpart in the nuclear industry. What is needed in the nuclear field is a reliable and predictable cost that is clearly competitive with alternative power sources. Reactors of our design are being built in other countries, particularly France and Japan, for costs and on schedules which would be highly competitive in the U.S. Returning to predictable and competitive costs in the U.S. will require aggressive action from industry, the Department of Energy (DOE), the Nuclear Regulatory Commission (NRC), and the Congress. Let me be more specific on the actions that we would like to see these sectors pursue.

Industry needs to provide a world-class Light Water Reactor (LWR) for the early 1990s that takes full advantage of this country's 25 years of experience in order to reduce costs and further improve reliability. How do we achieve this goal? It is our belief at Westinghouse, and it seems to be a view held by the nuclear industry, that standardization of design, more extensive factory fabrication of components, and simplification of the overall plant will result in cost-competitive plants. We are developing such a plant in Japan, with our licensee and partner, Mitsubishi Heavy Industries.

In providing these three elements, the U.S. nuclear industry needs to use both foreign and domestic information and resources. Valuable time and knowledge is being lost by reluctance to work more closely with our counterparts in Japan and Europe as well as other countries. Again, I will come back to this topic shortly.

Industry cannot pursue these actions I've just mentioned without accompanying DOE, NRC, and Congressional efforts. In order to provide an environment conducive to development of predictable and competitive costs for nuclear power plants, the government agencies, working with Congress, must provide five components. The first component is licensing reform, to simplify and shorten the licensing process to a one-step license for construction and operation of a plant. The recent Forbes article provides a hard-hitting but cogent view of the disastrous results of confused and time-consuming licensing procedures.

The second action required is for DOE, NRC, and Congress to factor recent advances in radiological source terms into emergency planning and other requirements. Again, confusion and lack of consistency in requirements have led to misunderstandings by utilities and delays in both nuclear design and construction.

As a third action, DOE and NRC must encourage standardization of designs to provide complete plant designs prior to licensing, thereby minimizing construction time backfitting requirements. Again, the Forbes article emphasizes the numerous design changes necessitated by different standards in effect at various times--all, of course, resulting in costly construction delays and rework. A standard design, based upon present studies and observation of current plant operations, would provide clarity, ease in licensing, and decreased costs. Several overseas plants, such as Kansai Electric Power Company's Takahama Unit #3, have been completed in greatly reduced time periods because of design standardization. In the case of Kansai, construction time was shortened from the average six years in Japan to a little over 49 months.

In line with design standardization, some standardization of and/or changes in state PUC regulations that permit the inclusion of Construction Work in Progress (CWIP) costs in the rate base would be a fourth, and highly desirable, action. Both state and federal agencies would then create a uniformity that provides the nuclear industry with definite direction and would reduce the licensing cycle, and, ultimately, the cost of nuclear power.

Finally, we would suggest that DOE and NRC continue an aggressive program to provide facilities for long-term nuclear waste disposal. As with licensing regulations and design standardization, a unified approach to the nuclear waste issue is extremely important for a long-term nuclear energy option.

Now let me return to discussion of what we mean by a nuclear world-class product! Let me now spend some time talking about the road that leads to this pinnacle and the curves on that road.

When nuclear power plants are ordered again--and we believe that the collective actions by utilities, DOE, NRC, and Congress discussed earlier will guarantee this--initially, some deferred plants will be completed, and some cancelled plants will be revived. The new nuclear plants will be upgraded versions of existing designs until the advanced world-class LWR designs are available. The process of change from current design to future design is gradual and evolutionary, not radical or revolutionary. The advanced LWR designs now being developed can meet the needs for nuclear power until sometime into the next century--how far into that century is uncertain. Two factors will affect that date for advanced LWR designs: the worldwide rate of growth of nuclear power and future discoveries of uranium.

Although energy growth rate has slowed considerably over the last several years, the demand for energy is still growing and will continue to do so as Third World countries and developed nations increase their demands for technologies that are energy-intensive. The slower rate may rather suddenly become a runaway number, as oil, coal, and uranium reserves decrease, one thing is certain: Uranium, as used in LWRs, is a depletable resource. The supply at acceptable recovery costs will run out.

You might ask if I have just found myself on a dead-end street by that statement. The answer is no. We have the roadbed of an advanced LWR design laid carefully and skillfully, and we will now build on that base in order to prevent our arrival at a dead-end in energy options. Since we believe that nuclear power will have an important role in meeting our needs through much of the next century, the next step in that technology will be required--the breeder reactor.

The Liquid Metal Fast Breeder Reactor (LMFBR) is in an advanced stage of development throughout the world. Successful, demonstrated operation of an LMFBR in a number of countries--France, U.K., Japan, Russia, and, soon, Germany, for example--makes the LMFBR the clear choice for meeting our longer-term needs. We've learned our lessons, both from these foreign plants and our own country's efforts. Today, we have all the benefits of a quarter century of 20-20 hindsight in looking at light water reactor operating plants and a somewhat more limited, but just as valid, hindsight in viewing the LMFBR technology. Let me provide examples of that experience.

Within the United States, the Experimental Breeder Reactor No. 2 (EBR-2) has operated successfully for more than 20 years. That's 20 years, not 2 or 10. In addition, the Fast Flux Test Facility (FFTF) at Hanford has operated successfully for five fuel cycles, providing valuable information on fuels and materials and many other aspects of LMFBR technology. These two facilities have been and should continue to be the cornerstones - or in our analogy of the road, perhaps the bedrock--of our LMR development program. We should continue to take full advantage of the excellent capabilities of FFTF and EBR-2 to carry out the essential elements of testing.

Although breeding capability will definitely be required in the future, our near-term development efforts should focus on reduced cost liquid metal reactors, even at the expense of breeding. To distinguish between a liquid metal reactor and an LMFBR, an LMR is similar to an LMFBR, but the two have different breeding ratio objectives and fuel cycle implications. Breeding ratio objectives for LMRs can be less than one; they can be fueled with enriched uranium rather than mixed plutonium-uranium; and they are not dependent on fuel cycle closure for deployment. These differences in objectives can enable the LMR to become economically viable before shortages in uranium supply escalate the price of uranium and result in a fuel cycle closure requirement. We should aim for a cost equivalent to alternative power sources, either nuclear or non-nuclear, to enable deployment and gain extensive operating experience with the LMR.

The question of nuclear plant size usually enters the discussions at this point. Westinghouse contacts with potential nuclear plant customers indicate that most have no particular interest in moving toward smaller nuclear plants in the future. In fact, in the low power range, up to several hundred megawatts electric, we believe that nuclear power plants will not be competitive with non-nuclear alternatives for a very long time. We feel that our focus for LMR development should be on plants with capacities of 500 MWe and upward. If competitive LMRs in this size range can be developed and used in the next few decades, breeder technology will be readily available in the form of LMFBRs when needed.

Based on a wealth of component design and testing information from the Clinch River project and the Large Prototype Breeder Reactor design and development, a product line can be developed for LMRs, from 500 MWe to 1000 MWe, by varying the number of heat transport trains while using many identical or scalable nuclear steam supply system components. Our LMR development program should be focused to support a competitive product line that does not require construction of an expensive demonstration plant.

The U.S. LMR program can move in the direction of a product line now by emphasizing the following elements in its program.

(1) Continued development of inherently safe LMR design approaches that minimize dependence on mechanical and operator actions. Westinghouse has been a leader in this area, and we have found several areas of convergence between inherently safe designs and low cost.

(2) Development of very long life core designs so that only one or two fuel loadings would be required over the life of the plant. Long core life

would improve plant availability, reduce operating costs, and lessen the need for fuel cycle operation, such as transportation and reprocessing.

(3) Continued development and demonstration of those LMR components, such as steam generators, that are high in both cost and risk.

(4) Development of designs conducive to more extensive factory fabrication, leading to shorter construction schedules and lower costs.

(5) Early and continuing interactions with NRC to establish appropriate licensing bases and to resolve "generic" issues in the early stages i order to minimize licensing delays later.

(6) Movement towards effective international agreements that could lead to information exchanges from foreign demonstration plant experiences and potential joint involvement in LMR fuel reprocessing. This task would require close cooperation between government and private industry.

Such a planned and focused program, based upon our already extensive data base and experiences at EBR-2 and FFTF, will result in a cost-competitive LMR product line. Rather than building costly demonstration plants, we should plan the program so that information available from our program and foreign exchanges would provide potential plant owners with confidence in construction costs and schedules, licensing schedules, operating costs, and financial risks. The first LMR plant from the product line would be one from the low power end of the line, thus requiring only a scaleup in thermal power from FFTF of about a factor of three, historically a scaleup that results in only moderate risk. In addition, use of components that are developed from already-designed and approved Clinch River components would save time and money. After the first product line plant, the road to the pinnacle is open, and any other plant sizes could be built and operated.

Let me quickly summarize the road I just took you down, the road that leads to the revitalization of nuclear power:

- The revitalization of nuclear power requires aggressive action from industry, DOE, NRC, and Congress.
- The most important requirement for nuclear power is to achieve predictable and competitive costs.
- Light water reactors will meet the bulk of our nuclear power requirements for the next several decades.
- But breeders will be needed eventually to extend our natural resource base.

- Because of the advanced stage of development of the LMFBR and its successful operating experience around the world, it is the clear choice for the breeder when needed.
- In the meantime, we should take advantage of the liquid metal technology and focus our advanced reactor development efforts on a cost-competitive LMR which can be readily converted to a LMFBR when needed.
- The size range of interest is 500 MWe and upward.
- And, finally, the approach makes effective use of FFTF and EBR-2 nd information from foreign demonstration plants. No building of a demonstration plant is required.

Ted Stern, our Executive Vice President of Nuclear Energy Systems at Westinghouse, recently remarked that, "It is in this interlocking pattern of a mature technology and progressive engineering that both the present and future of nuclear energy lies. No one who does not have a quarter century, and billions of dollars to burn, can think of beginning this intricate, slow-growing process all over again." There is a road that leads to a revitalized nuclear industry. Many of the turns and bumps are known, and most of the road is well-travelled. We at Westinghouse want to continue the journey. The horizon beckons.

Thank you for your time.

W. HOWARD ARNOLD
GENERAL MANAGER
ADVANCED ENERGY SYSTEMS DIVISION

Dr. Arnold heads the Division of Westinghouse responsible for development of both advanced nuclear reactors and alternate energy sources. This Division, along with the Westinghouse Hanford Company, the Westinghouse Idaho Nuclear Company, and the Waste Technology Service Division, is in turn part of the Advanced Power Systems business unit. The major programs currently underway in Dr. Arnold's division are development work for breeder reactors, nuclear reactors for defense applications other than naval propulsion, fuel cell terrestrial power plants, solar photovoltaic power modules, electrical wind turbine systems, and MHD and other emerging energy technologies.

Prior to his current assignment, Dr. Arnold's career has involved a broad range of technical and management responsibilities in the energy and defense fields. He was associated with the NERVA nuclear rocket program from 1962 to 1968, directly responsible for test operations in Nevada during four successful tests, and then becoming NERVA program manager. In the Westinghouse Defense Center, he was Manager, Underseas Weapons Department from 1968-71, when the development of the Mk48 torpedo, current mainstay of the fleet, was successfully completed. Associated with Westinghouse commercial pressurized water reactor power plants from 1955-61 and from 1971-81, he became General Manager, PWR Systems Division in 1972 and President, Westinghouse Nuclear International in 1979. In these positions, he was responsible for the design, nuclear safety, and project management of 98 Westinghouse PWR nuclear steam supply systems and for technical support of an additional 66 built by Westinghouse licensees. In 1981, he became General Manager of the Advanced Reactors Division which was combined with the alternate energy operations in 1983 to become the Advanced Energy Systems Division.

Dr. Arnold joined Westinghouse in 1955 as a senior engineer in reactor design after earning a doctorate and masters degrees in physics at Princeton University, and his bachelor's degree in physics and chemistry at Cornell University in 1951. He was elected to the National Academy of Engineering in 1974, is a registered nuclear engineer in Pennsylvania, and a Fellow of the American Nuclear Society and the American Association for the Advancement of Science. He was born at Jefferson Barracks, Missouri, in 1931, and married Josephine Routheau in 1952. They live in Pittsburgh where they have raised five children.

Mr. STALLINGS. Thank you very much, Dr. Arnold.

Mr. Nolan, would you like to begin?

STATEMENT OF JOHN E. NOLAN, DIRECTOR, HANFORD ENGINEERING DEVELOPMENT LABORATORY

Mr. NOLAN. Congressman Stallings, members of the subcommittee, I am John Nolan, director of the Department of Energy's Hanford Engineering Development Laboratory. Our laboratory is deeply committed to performing research and development for the Advanced Reactor Program. I am pleased to have this opportunity to provide testimony regarding liquid metal reactors.

The technology of the U.S. LMR Program is a success story today and is on the brink of additional applied research achievements. We have built, and now operate at Hanford, major facilities which include the fast-flux test facility and the fuels and materials examination facility as well as supporting laboratories.

Photographs of these facilities and factsheets summarizing their key achievements and objectives are attached to my written testimony.

The technology reflected in and being advanced by these facilities, and the expertise of the people involved, are at the forefront of the world's energy development. They are of vital importance to maintaining our options and assurance of abundant energy.

Others have testified to this subcommittee about the importance of nuclear power to this country's electrical energy supply today and even more so in the future. The liquid metal reactor is the logical bridge from the nuclear reactors of today which consume the finite resource uranium-235 to the virtually inexhaustible energy resource represented by uranium-238 used in liquid metal breeder reactors.

As Dr. Arnold stated, the liquid metal reactor without breeding is a good candidate for an advanced simpler, inherently safe, economic nuclear powerplant. Ultra-long-life cores can be designed which utilize and burn uranium or plutonium in place. Research and development on liquid metal reactors builds the technology and experience which can lead directly to liquid metal breeder reactors. Such R&D needs to be continued today because no alternative major new energy system can be simply called into existence when needed. Lead times of at least 10 to 20 years are needed.

At the Hanford Engineering Development Laboratory, we have the fast-flux test facility, the most advanced test reactor of its kind in the world. The outstanding operation of the FFTF over the past 3 years is an achievement of which our Nation can be proud. This unique facility has achieved operational reliability records that rank with the best in the world. The plant is now in its sixth operating cycle. It has operated a total of about 600 equivalent full-power days to date, exceeding the plan laid out in 1982. This 400-megawatt liquid metal reactor plant, systems and components have performed well and provide data for future plant design.

The FFTF has produced technical data never before obtainable. The performance of the initial FFTF fuel assemblies and neutron-absorbing control rods, the core system designed about 15 years ago, has been particularly impressive. The in-core residence time of these components has exceeded design objectives without a single failure. More than 30,000 commercially fabricated fuel pins have been irradiated in the first 5 cycles of FFTF operation, establishing a large data base which will apply to future LMR fuel design.

The FFTF initial core components have functioned flawlessly, but definite limits to their performance are now being clearly confirmed. Because the characteristics of the materials best known at that time would limit the initial core system to a lifetime of about 1 year, a comprehensive research and development effort was instituted in the late 1970's.

As a result, the United States has recently achieved another world technology breakthrough. Capitalizing on improved radiation-damage-resistant materials, first tested in EBR-2 and then developed with power-reactor-sized component tests in the FFTF, an experiment for development of a long-lifetime core system has been implemented. This involves the irradiation in FFTF, starting next year, of a partial core loading of long-lived core components, collectively known as the core demonstration experiment.

This experiment will provide a large-scale proof test of the performance capabilities of the core components with at least a 3-year lifetime and a three- or- fourfold increase in energy production. This irradiation will be finished in 1990. Such performance levels will make it possible to realize superior fuel cycle economics.

The U.S. world leadership in reactor fuels and materials research and development will give us a bargaining chip in achieving international collaboration goals.

In addition to the prime FFTF missions of irradiation testing and of gaining plant operating and maintenance experience, the plant has another essential mission: That of testing advanced control and advanced control room concepts, or inherent safety features of new liquid metal reactors.

FFTF and its components were designed and built with many of the inherent safety characteristics that will be needed, and it is an invaluable test bed to demonstrate other safety characteristics and features.

In addition to operating the plant and longer lifetime fuel systems, the laboratory has the lead responsibility for mixed oxide fuel fabrication technology in this country. The fuels and materials examination facility has been built as a modern, fully safe and safeguarded fuel laboratory, and is without equal. Its construction was completed in June on schedule and on budget. The world's first secure automated fuel fabrication line is being installed in the FMEF, and the installation will be 80 percent complete by the end of this fiscal year.

This line will provide the capability to prove out fabrication processes and to remotely manufacture fuel for the FFTF or other LMR plants.

State-of-the-art safeguards and security applications will provide advanced technology regarding inventory control, material accountability, and nondestructive assaying of material, which will help us have a creditable position for the United States in proliferation concerns.

With respect to program funding, it is my belief that the program at Hanford, if not nationally, has been reduced in 1985 to the point that we are unable to sustain the level of R&D capability that should be maintained. Our total funding has decreased 42 percent since 1981, and the LMR-supported people available to accomplish our achievements have been reduced from 2,600 to 1,350. One out of every two people will be gone by the end of 1985 fiscal year.

If in 1986 fiscal year the operating funding falls 20 percent below 1985, our manpower will have to be reduced by another 350 to 400 people. We could not continue to operate FFTF at the levels of efficiency achieved in the past, there would be a substantial delay in getting long-life fuel data for use by innovative designers or for international exchange, and the SAF fuel fabrication line startup would be delayed 12 to 15 months, and the basic infrastructure which supports proper operation would be dismantled.

The advances that we're on the brink of achieving would have to be put off and our ability to be on the cutting edge of technology compromised. Our capability to maintain an international leadership role in reactor fuels and materials technology would be threatened.

In conclusion, the subcommittee's support for research and development is vital to the Advanced Reactor Program, in which operation of the FFTF, the development of the 3-year core lifetime fuel, and the completion of the secure automated fuel fabrication line are key elements.

Your continued support will keep the liquid metal reactor option viable for the United States, enhance this country's ability to achieve international collaboration agreements, enhance this country's ability to have a role in controlling proliferation.

Thank you for allowing me to testify.

[The prepared statement of Mr. Nolan follows:]

STATEMENT OF
JOHN E. NOLAN, DIRECTOR
HANFORD ENGINEERING DEVELOPMENT LABORATORY
BEFORE THE
U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION

MADAM CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE:

I AM JOHN NOLAN, THE DIRECTOR OF THE HANFORD ENGINEERING DEVELOPMENT LABORATORY. OUR LABORATORY IS DEEPLY COMMITTED TO THE DEPARTMENT OF ENERGY'S ADVANCED REACTOR PROGRAM. I AM PLEASED TO HAVE THIS OPPORTUNITY TO PROVIDE TESTIMONY ON THIS IMPORTANT ACTIVITY, ESPECIALLY REGARDING THE LIQUID METAL REACTOR (LMR).

THE TECHNOLOGY OF THE U.S. LMR PROGRAM IS, TODAY, A SUCCESS STORY. WE HAVE BUILT AND NOW OPERATE AT HEDL, MAJOR FACILITIES WHICH INCLUDE THE FAST FLUX TEST FACILITY (FFTF), THE FUELS AND MATERIALS EXAMINATION FACILITY (FMEF), AND SUPPORTING LABORATORIES. PHOTOGRAPHS OF THESE FACILITIES AND FACT SHEETS SUMMARIZING THEIR KEY ACHIEVEMENTS AND OBJECTIVES ARE ATTACHED TO THIS TESTIMONY.

THE TECHNOLOGY REFLECTED IN AND BEING ADVANCED BY THESE FACILITIES, AND THE EXPERTISE OF THE PEOPLE INVOLVED, ARE AT THE FOREFRONT OF THE WORLD'S ENERGY DEVELOPMENT. THEY ARE OF VITAL IMPORTANCE TO MAINTAINING OUR OPTIONS AND ASSURANCE OF ABUNDANT ENERGY.

MANY QUESTIONS ARE BEING ASKED TODAY ABOUT NUCLEAR POWER IN THE UNITED STATES. NEVERTHELESS, NUCLEAR ENERGY IS ALREADY AN ESSENTIAL ELEMENT OF THE U.S. AND WORLD ENERGY SUPPLY - - AND ITS IMPORTANCE WILL CONTINUE TO GROW AS WE MOVE INTO THE NEXT CENTURY.

THE LIQUID METAL REACTOR IS THE LOGICAL BRIDGE FROM THE NUCLEAR REACTORS OF TODAY, WHICH CONSUME THE FINITE RESOURCE URANIUM-235, AND THE VIRTUALLY INEXHAUSTIBLE ENERGY RESOURCE REPRESENTED BY URANIUM-238 USED IN LIQUID METAL BREEDER REACTORS.

THE LIQUID METAL REACTOR, WITHOUT BREEDING, IS A GOOD CANDIDATE FOR AN ADVANCED, SIMPLER, INHERENTLY SAFE, ECONOMIC NUCLEAR POWER PLANT. IT ALSO BUILDS THE TECHNOLOGY AND EXPERIENCE WHICH LEAD DIRECTLY TO THE LIQUID METAL BREEDER REACTOR.

IF THE BREEDER IS NOT NEEDED UNTIL THE NEXT CENTURY, WHY WORRY ABOUT IT NOW? BECAUSE NO ALTERNATIVE MAJOR NEW ENERGY SYSTEM CAN BE SIMPLY CALLED INTO EXISTENCE WHEN NEEDED. EXPERIENCE HAS SHOWN THAT CONTINUED DEVELOPMENT INTO THE LATE 1990'S WILL BE NEEDED BEFORE A COMPETITIVE COMMERCIAL OFFERING OF A NEW REACTOR TYPE CAN BE MADE. EQUALLY IMPORTANT IT WILL BE AT LEAST 2010 BEFORE EVEN A FEW PLANTS CAN BE CONSTRUCTED AND PROVE THAT THEY CAN RELIABLY GENERATE THEIR PART OF THE COUNTRY'S ELECTRICAL LOAD.

ACCORDINGLY, THERE ARE UNIQUE AND COMPELLING REASONS TO MAINTAIN A STRONG UNITED STATES LIQUID METAL REACTOR PROGRAM.

AT THE HANFORD ENGINEERING DEVELOPMENT LABORATORY WE HAVE THE FAST FLUX TEST FACILITY, THE MOST ADVANCED TEST REACTOR OF ITS KIND IN THE WORLD. THE OUTSTANDING OPERATION OF THE FFTF OVER THE PAST THREE YEARS IS AN ACHIEVEMENT OF WHICH OUR NATION CAN BE PROUD. THIS UNIQUE FACILITY HAS

ACHIEVED OPERATIONAL AND RELIABILITY RECORDS THAT RANK WITH THE BEST IN THE WORLD. THE PLANT IS NOW IN ITS SIXTH OPERATING CYCLE. IT HAS OPERATED A TOTAL OF ABOUT 600 EQUIVALENT FULL POWER DAYS TO DATE, EXCEEDING THE PLAN LAID OUT IN 1982. THE PLANT SYSTEMS AND COMPONENTS HAVE PERFORMED WELL AND PROVIDED DATA FOR FUTURE PLANT DESIGNS. REFLECTING THE OPERATIONAL SAFETY OF THIS TYPE OF PLANT, THE TOTAL RADIATION EXPOSURE TO OPERATING AND SUPPORT PERSONNEL HAS BEEN ONLY 5 - 10 MAN-REM PER YEAR, A FACTOR OF 100 LESS THAN FOR LIGHT WATER REACTORS.

AT LEAST AS IMPORTANT AS THE FFTF'S OPERATING RECORD, IS ITS SUCCESS IN PRODUCING TECHNICAL DATA NEVER BEFORE ATTAINABLE. THE PERFORMANCE OF THE INITIAL FFTF FUEL ASSEMBLIES AND NEUTRON-ABSORBING CONTROL RODS, A CORE SYSTEM DESIGNED ABOUT 15 YEARS AGO, HAS BEEN PARTICULARLY IMPRESSIVE. THE IN-CORE RESIDENCE TIME OF THESE COMPONENTS HAS EXCEEDED DESIGN OBJECTIVES WITHOUT A SINGLE FAILURE. MORE THAN 30,000 COMMERCIALLY-FABRICATED FUEL PINS HAVE BEEN IRRADIATED IN THE FIRST FIVE CYCLES OF FFTF OPERATION, ESTABLISHING A LARGE DATA BASE WHICH WILL APPLY TO FUTURE LMR FUEL DESIGN. THE FFTF INITIAL CORE COMPONENTS HAVE FUNCTIONED FLAWLESSLY; BUT DEFINITE LIMITS TO THEIR PERFORMANCE ARE NOW BEING CLEARLY CONFIRMED.

BECAUSE THE CHARACTERISTICS OF THE MATERIALS BEST KNOWN AT THAT TIME, WOULD LIMIT THE INITIAL CORE SYSTEM TO A LIFETIME OF ABOUT ONE YEAR, A COMPREHENSIVE TECHNOLOGY DEVELOPMENT EFFORT WAS INSTITUTED IN THE LATE 1970's. AS A RESULT, THE UNITED STATES HAS RECENTLY ACHIEVED ANOTHER WORLD TECHNOLOGY BREAKTHROUGH WHICH PROMISES TO RAISE LMR CORE COMPONENT PERFORMANCE TO A LEVEL OF SUPERIOR FUEL CYCLE ECONOMICS. CAPITALIZING ON IMPROVED RADIATION DAMAGE RESISTANT MATERIALS FIRST TESTED IN EBR-II AND DEVELOPED WITH POWER-REACTOR SIZE COMPONENT TESTING IN THE FFTF, AND APPLYING THE BETTER UNDERSTANDING OF FUEL ASSEMBLY BEHAVIOR GAINED THROUGH EVALUATION OF FFTF CORE PERFORMANCE, A MAJOR NEW INITIATIVE FOR DEVELOPMENT OF A LONG LIFETIME CORE SYSTEM HAS BEEN IMPLEMENTED. THIS INITIATIVE INVOLVES THE IRRADIATION IN FFTF STARTING NEXT YEAR OF A PARTIAL CORE LOADING OF LONG-LIFE CORE COMPONENTS, COLLECTIVELY KNOWN AS THE CORE DEMONSTRATION EXPERIMENT (CDE). THE CDE WILL PROVIDE A LARGE-SCALE PROOF TEST OF THE PERFORMANCE CAPABILITIES OF CORE COMPONENTS WITH A SEVERAL-FOLD INCREASE IN ENERGY PRODUCTION. THIS IRRADIATION WILL BE FINISHED IN 1990. SUCH PERFORMANCE LEVELS WILL MAKE IT POSSIBLE TO REALIZE THE ECONOMICS AND SAFETY OBJECTIVES NECESSARY FOR LMR DEPLOYMENT.

IN ADDITION TO THE PRIMARY FFTF MISSIONS OF IRRADIATION TESTING AND OF GAINING PLANT OPERATING AND MAINTENANCE EXPERIENCE; IT HAS ANOTHER ESSENTIAL MISSION - - THAT OF TESTING ADVANCED CONTROL OR INHERENT SAFETY FEATURES FOR NEW LIQUID METAL REACTORS. AS THIS SUBCOMMITTEE KNOWS, THE NEXT GENERATION OF NUCLEAR PLANTS IN THIS COUNTRY WILL NEED TO DEMONSTRATE INHERENT SAFETY. THE LICENSING AGENCIES AND THE PUBLIC MUST BE ASSURED THAT THESE PLANTS ARE AT LEAST AS SAFE AS OTHER FORMS OF ENERGY GENERATION OR INDUSTRIAL ACTIVITY. FFTF AND ITS COMPONENTS WERE DESIGNED AND BUILT WITH MANY OF THE INHERENT SAFETY CHARACTERISTICS THAT WILL BE NEEDED AND

IT IS AN INVALUABLE TEST BED TO DEMONSTRATE CONCLUSIVELY OTHER SAFETY CHARACTERISTICS AND FEATURES. THESE RANGE FROM VERIFICATION TESTING OF INHERENT SHUTDOWN MECHANISMS, SUCH AS CONTROL RODS OPERATING ON CHANGES IN TEMPERATURES, TO SPECIFIC DEMONSTRATION OF INHERENT SHUTDOWN MECHANISMS BASED ON FUNDAMENTAL PHENOMENA.

IN ADDITION TO THE REACTOR AND CORE SYSTEMS DEVELOPMENT, HEDL HAS THE LEAD RESPONSIBILITY FOR MIXED OXIDE FUEL FABRICATION TECHNOLOGY.

THE FUELS AND MATERIALS EXAMINATION FACILITY (FMEF) HAS BEEN BUILT AS A MODERN, FULLY SAFE AND SAFEGUARDED FUELS LABORATORY, AND IS WITHOUT EQUAL. ITS CONSTRUCTION WAS COMPLETED IN JUNE 1984, ON SCHEDULE AND ON BUDGET.

THE WORLD'S FIRST SECURE AUTOMATED FUEL (SAF) FABRICATION LINE IS BEING INSTALLED IN FMEF, AND INSTALLATION WILL BE 80 PERCENT COMPLETE BY THE END OF FISCAL YEAR 1985. THIS FABRICATION LINE WILL PROVIDE THE CAPABIITY TO PROVE OUT THE PROCESSES AND REMOTELY MANUFACTURE FUEL FOR THE FFTF, OR OTHER LMR PLANTS, AS CIRCUMSTANCES DEMAND. AUTOMATED FABRICATION OF MIXED OXIDE FUEL WITH STATE-OF-THE-ART SAFEGUARDS AND SECURITY WILL HELP ESTABLISH THE ECONOMICS OF LIQUID METAL REACTORS, AND WILL PROVIDE ADVANCED TECHNOLOGY REGARDING INVENTORY CONTROL AND NON-DESTRUCTIVE ASSAYING OF SPECIAL NUCLEAR MATERIAL THAT CAN BE USED TO ASSIST NON-PROLIFERATION OBJECTIVES. IMPROVED QUALITY, HIGHER PRODUCTIVITY, AND MINIMUM PERSONNEL RADIATION EXPOSURE WILL BE ACHIEVED. THE SUCCESSFUL OPERATION OF THE SAF LINE, NOW SCHEDULED FOR OPERATION IN 1987, WILL PLACE THE U.S. IN A POSITION OF WORLD LEADERSHIP IN THIS AREA OF NUCLEAR TECHNOLOGY.

THE SUB-COMMITTEE IS FAMILIAR WITH THE CHANGE IN FMEF MISSIONS TO FOREGO THE ORIGINAL PLANS FOR POST-IRRADIATION EXAMINATION AND TO CONSIDER THE FACILITY FOR A JOINT ORNL/HEDL REPROCESSING PROGRAM CALLED THE BREEDER REPROCESSING ENGINEERING TEST (BRET). THE BRET PROJECT IS NOT PART OF THE DOE FY-1986 BUDGET PROPOSAL, HOWEVER, DEVELOPMENT OF BREEDER REPROCESSING TECHNOLOGY AT SOME POINT IS ESSENTIAL. BRET, OR SOME OTHER REPROCESSING INITIATIVE WOULD BE VERY COMPATIBLE WITH FMEF.

WITH RESPECT TO PROGRAM FUNDING, IT IS MY BELIEF THAT THE LMR PROGRAM AT HEDL, IF NOT NATIONALLY, HAS BEEN REDUCED IN FY-1985 TO THE POINT THAT WE ARE UNABLE TO SUSTAIN A LEVEL OF BASE TECHNOLOGY THAT SHOULD BE MAINTAINED. OUR TOTAL LMR FUNDING HAS DECREASED 42% SINCE FY-1981 AND THE LMR SUPPORTED PEOPLE AVAILABLE TO ACCOMPLISH OUR ACHIEVEMENTS WERE REDUCED FROM 2600 TO 1350. IF IN FY-1986 OUR OPERATING FUNDING FALLS 20% BELOW FY-1985, OUR LMR MANPOWER WILL HAVE TO BE REDUCED BY 350 TO 400 PEOPLE (SEE ATTACHMENTS 1 AND 2). WE COULD NOT CONTINUE TO OPERATE FFTF AT THE LEVELS OF EFFICIENCY ACHIEVED IN THE PAST, THERE WOULD BE A SUBSTANTIAL DELAY IN GETTING LONG LIFE FUEL DATA FOR USE BY INNOVATIVE DESIGNERS OR FOR INTERNATIONAL EXCHANGE, THE SAF FUEL FABRICATION LINE STARTUP WOULD BE DELAYED 12 - 15 MONTHS, AND THE BASIC INFRASTRUCTURE THAT SUPPORTS PROPER OPERATION WOULD BE THREATENED. BEYOND FY-1986 THE HEDL REQUIREMENTS TO SUPPORT THE DEPARTMENT'S LMR PROGRAM WILL BE DEVELOPED IN COOPERATION WITH THE DEPARTMENT AS FUTURE YEAR PROGRAMS ARE DEFINED.

THIS SUBCOMMITTEE'S SUPPORT FOR RESEARCH AND DEVELOPMENT IS VITAL TO THE ADVANCED REACTOR PROGRAM OF WHICH OPERATION OF THE FFTF, THE DEMONSTRATION OF A THREE-YEAR CORE LIFETIME FUEL, AND THE COMPLETION OF THE SECURE AUTOMATED FUEL FABRICATION LINE ARE KEY ELEMENTS. YOUR CONTINUED SUPPORT WILL KEEP THE LIQUID METAL REACTOR OPTION VIABLE FOR THE UNITED STATES, ENHANCE THIS COUNTRY'S ABILITY TO ACHIEVE INTERNATIONAL COLLABORATION AGREEMENTS, AND ENHANCE THIS COUNTRY'S ABILITY TO HAVE A ROLE IN CONTROLLING PROLIFERATION.

THANK YOU FOR YOUR PAST SUPPORT AND FOR ALLOWING ME TO TESTIFY TODAY

ATTACHMENTS:
1. HEDL LMR Funding Profile 1981-1985
2. HEDL Manpower Profile 1981-1985
3. Fast Flux Test Facility
4. Core Demonstration Experiment
5. Fuels and Materials Examination Facility
6. Secure Automated Fabrication Line
7. Materials Open Test Assembly
8. Artificial Intelligence

John E. Nolan
Director
Hanford Engineering Development Laboratory

Mr. Nolan has been Director of the Hanford Engineering Development Laboratory and President of Westinghouse Hanford Company since 1980. Throughout his 35-year career, he has been directly involved in many of the country's advanced nuclear development projects and programs. The successful projects and programs Mr. Nolan has been proudly associated with include the U.S.S. NAUTILUS, the first nuclear submarine; the U.S.S. ENTERPRISE and U.S.S. LONG BEACH, the first nuclear surface ships; the SHIPPINGPORT ATOMIC POWER STATION, the first commercial nuclear power plant in the United States; the CLINCH RIVER BREEDER REACTOR PROJECT; and the FAST FLUX TEST FACILITY, the world's largest and most successful advanced test reactor.

Mr. Nolan started his career at Westinghouse in 1950 on the Graduate Student Program. He joined the Bettis Atomic Power Laboratory in 1951 and held various assignments there for 18 years. From 1951 to 1955, he designed instrumentation and control systems for the first nuclear submarine, the U.S.S. NAUTILUS, and its prototype (S1W). From 1955 to 1957, Mr. Nolan managed a group responsible for the test program and overall plant analysis for the first commercial nuclear power station in the country, the Shippingport Atomic Power Station. From 1958 to 1960, he had various control and plant engineering management assignments for the first surface ships and their prototype (A1W). From 1960 to 1965, Mr. Nolan was responsible for the plant engineering efforts associated with increasing the capability of the Shippingport Atomic Power Station from 60 to 150 MW(e).

From 1965 to 1969, he was Director of Naval Training at Bettis, responsible for curriculum, textbooks, and training methods for the officers and enlisted personnel of the U.S. Nuclear Navy.

In 1969, Mr. Nolan transferred to Westinghouse's Advanced Reactors Division where he worked on the design of the Fast Flux Test Facility through 1975. Mr. Nolan was involved in the design of the Clinch River Breeder Reactor Plant from 1976 to 1979, serving as Westinghouse's Project Manager for the CRBRP from 1977 to 1979. In September 1979, he transferred to the Westinghouse Hanford Company (WHC) and became the FFTF Project Manager. In August 1980, Mr. Nolan became WHC President with responsibility for directing the Hanford Engineering Development Laboratory for the U.S. Department of Energy.

John Nolan is a Senior Member of the Institute of Electrical and Electronic Engineers (IEEE) and a member of the American Society of Mechanical Engineers (ASME) and the American Nuclear Society (ANS), and is listed in American Men of Science, Who's Who in Engineering, and Who's Who in Atoms. Mr. Nolan participated as a member of the Atomic Energy Commission plant design team's visit to Europe in 1971. He was a member of the U.S. Liquid Metal Fast Breeder Reactor Plant Experience Working Group and visited Japan in 1978. He was born in Brooklyn, N.Y. in 1925 and married Dorothea Scheuermann in 1952. They live in Richland, Washington and have raised seven children.

ATTACHMENT 1

HANFORD ENGINEERING DEVELOPMENT LABORATORY
LMR/LMFBR COST/FUNDING PROFILE

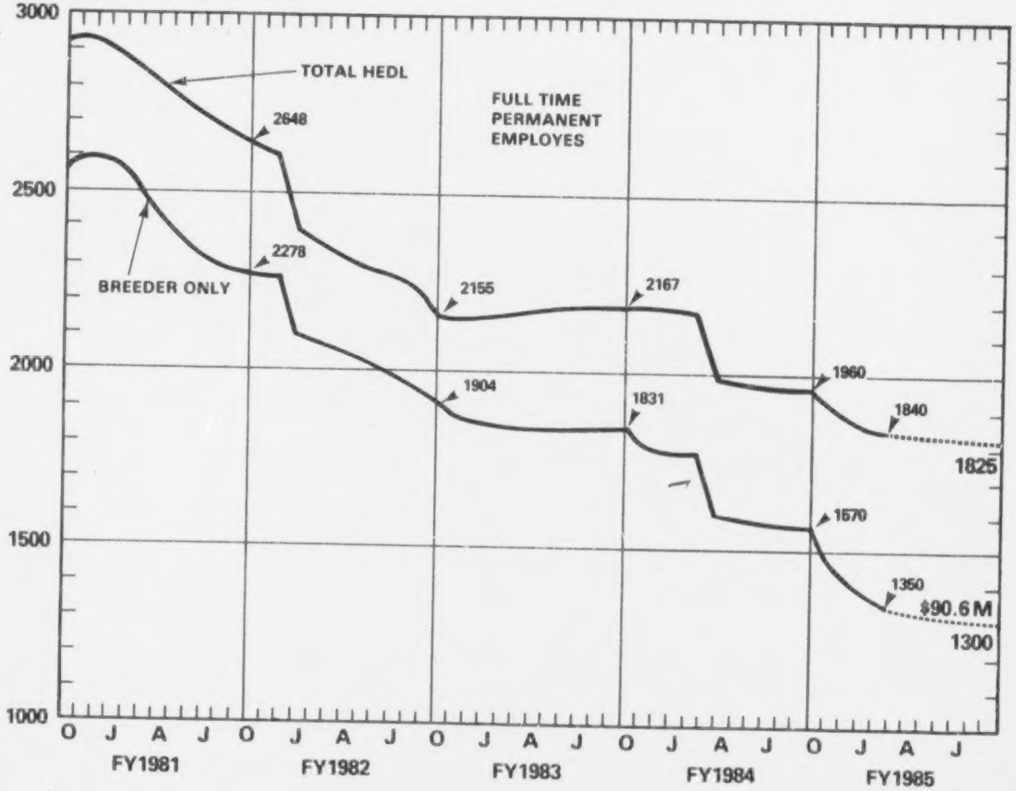
	Actual				Budget
	1981	1982	1983	1984	1985
Operating $M B/O					
FFTF Complex	69.0	70.9	53.2	50.5	46.9
Fuel Supply	4.9	5.6	4.7	5.3	12.0
Fuel Cycle Plant	17.3	20.9	24.7	23.1	17.6
Fuel/Core Comp R&D	13.7	13.8	13.8	11.3	9.3
Base Technology R&D	10.7	9.8	9.8	8.8	3.6
Other	2.1	1.7	1.5	1.2	1.2
Total Operating	117.7	122.7	107.7	100.2	90.6
Capital $M B/A					
Equipment	5.7	16.3	12.7	17.6	11.8
General Purpose Proj. & Mods. to Reactors	2.2	2.8	2.4	2.4	4.4
Line Items	58.0	39.7	6.9	4.0	-
Total Capital	65.9	58.8	22.0	24.0	16.2
Total LMR/LMFBR	183.6	181.5	129.7	124.2	106.8

2/14/85

ATTACHMENT 2

HANFORD ENGINEERING DEVELOPMENT LABORATORY

HEDL PERSONNEL



HEDL 8410-229.4
2-20-85

ATTACHMENT 3

FAST FLUX TEST FACILITY Program Highlights

Fast Flux Test Facility

A PLANT WITH A PURPOSE:

- 400 MWt highly instrumented liquid metal test reactor
- Designed to test advanced fuels and core materials
- Operated to verify and improve reactor component performance
- A major step in the US effort to gain energy independence

AN ENGINEERING SUCCESS:

- Completed on schedule and within budget	6/78
- Achieved initial criticality	2/80
- Completed startup tests and started cycle operations	4/82
- Selected as top engineering project of 1982 by NSPE	1982
- Set US record for continuous operation at full power	11/84

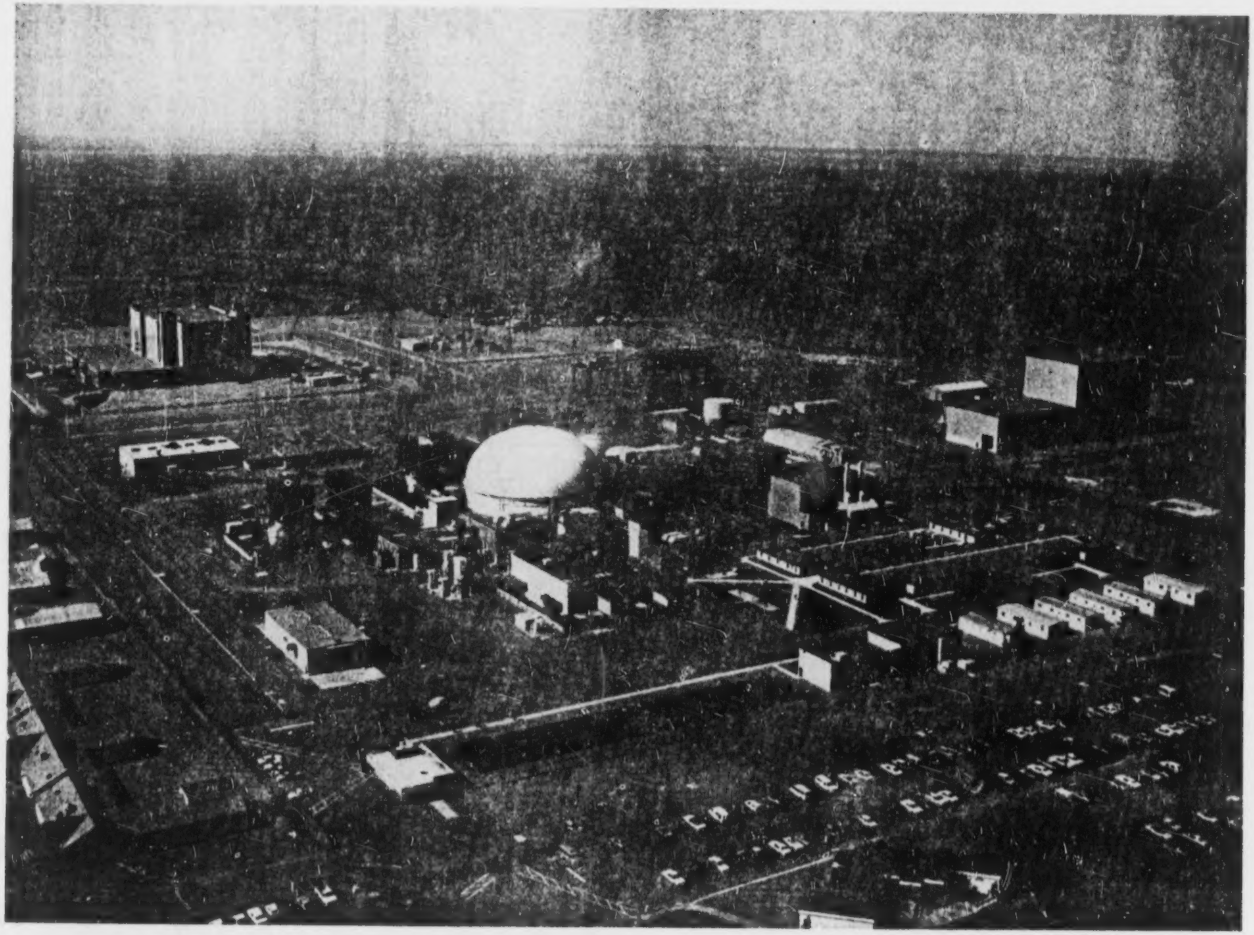
A TECHNOLOGICAL SUCCESS:

- Exceeded goal burnup of initial fuel by 50% -- 119,000 MWd/MTM
- Achieved 129,000 MWd/MTM burnup in a full size experimental assembly
- Irradiated 113 full size experiments and approximately 3800 material specimens to date
- Demonstrated performance of major plant components through 597 full power days of operation
- Achieved annual capacity factor of 66.4% in 1984 -- more than 10% above the average for light water reactors.

A CONTINUING RESOURCE:

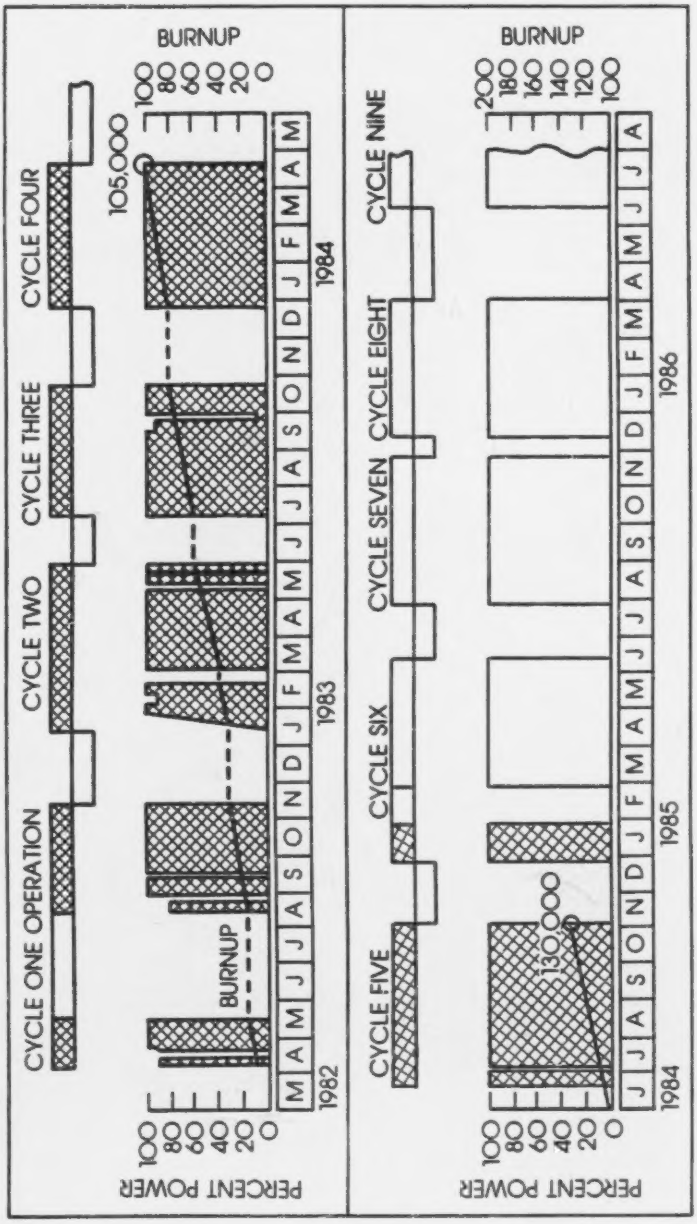
- Nuclear Economics
  - -- demonstration of prototypic size of long life fuel assembly performance e.g., Core Demonstration Experiment
  - -- irradiation of alloys for ultra-long life cores in Materials Open Test Assemblies (MOTA)
- Nuclear Safety
  - -- demonstration of inherent safety features
- International Policy
  - -- retention of US influence in international non-proliferation policies
- Advanced Technology
  - -- development of US technological leadership in nuclear physics
- Commercial Application
  - -- support of advanced commercial technologies e.g., food irradiation

ATTACHMENT 3

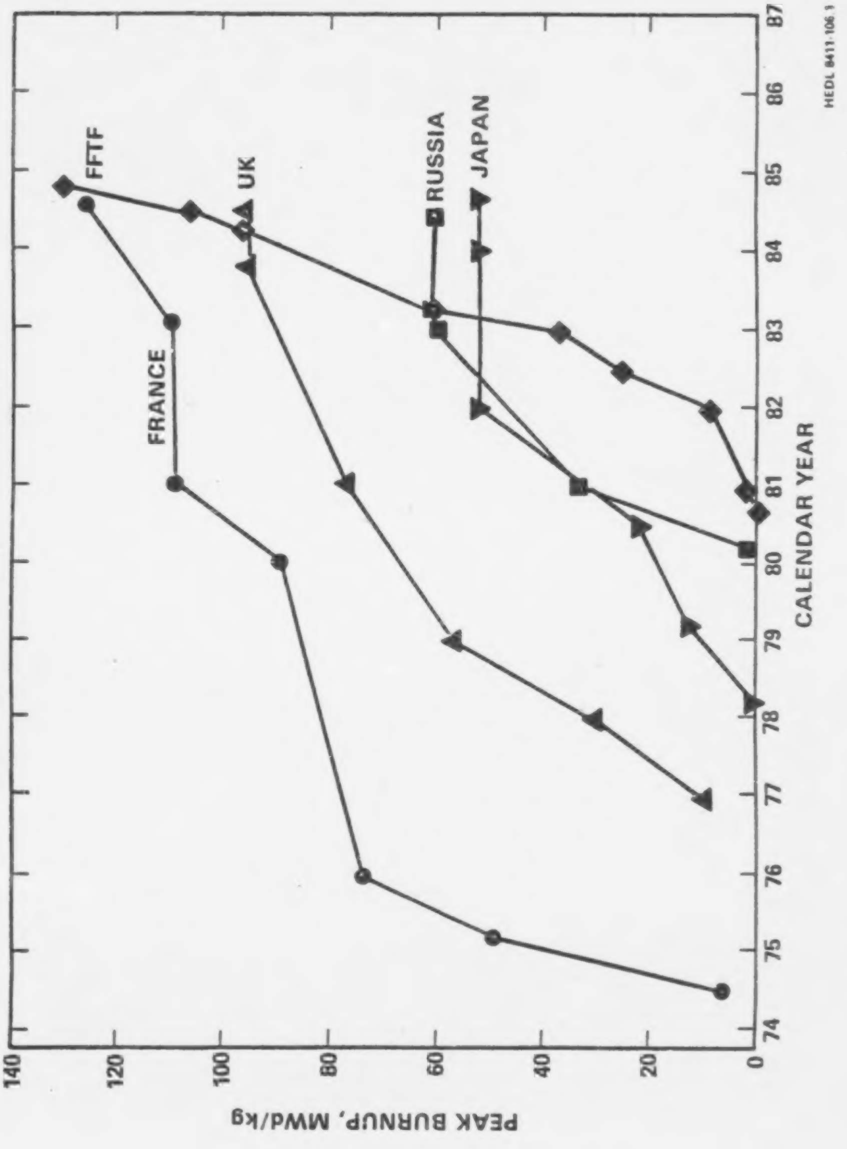


ATTACHMENT 3

FFTF OPERATING HISTOGRAM



ATTACHMENT 3

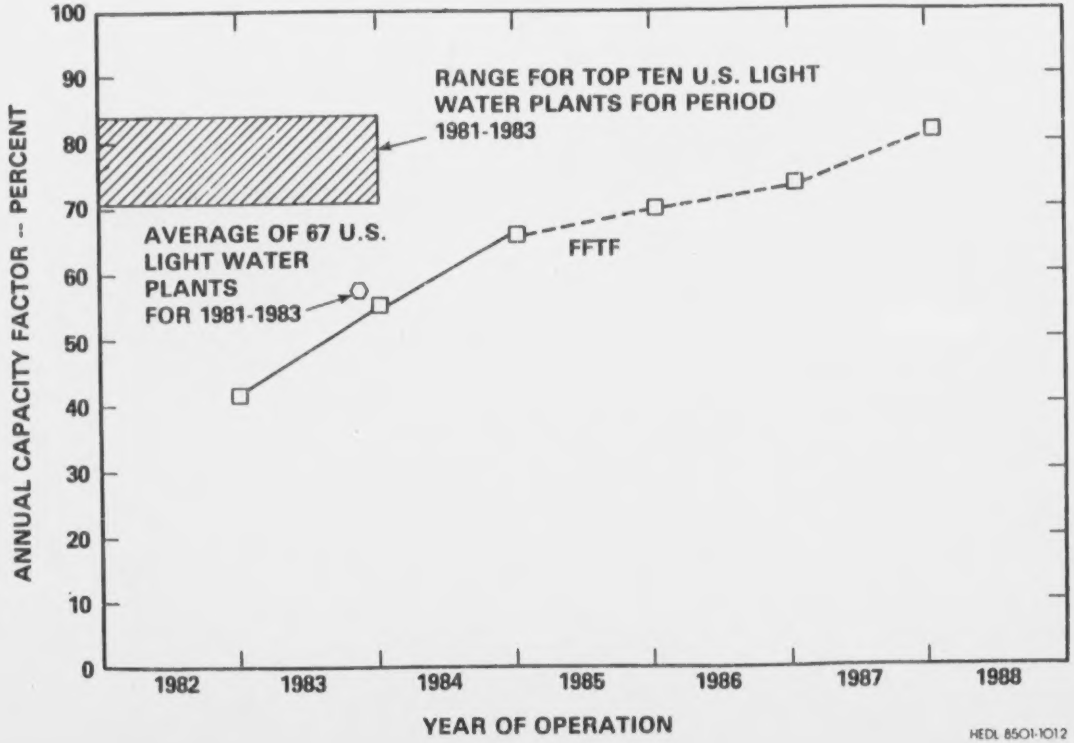


BURNUP ACHIEVEMENTS WITH MIXED-OXIDE FUEL

ATTACHMENT 3

FFTF

CAPACITY FACTOR BETTER THAN LWR AVERAGE



HEDL 8501-1012

ATTACHMENT 4

CORE DEMONSTRATION EXPERIMENT (CDE)

BACKGROUND

- The Core Demonstration Experiment (CDE) fuel and blanket assembly designs are similar to the FFTF, using hermetically sealed wire wrapped fuel pins in a hexagonal duct however, the fuel pins are larger in diameter. Other design changes were made to provide for the extended lifetime capability. These changes were based on performance data gained from the initial FFTF fuel assemblies and data from technology programs on advanced materials.

SCOPE

- Irradiation for 3 years in FFTF of 10 advanced design fuel assemblies and 6 inner blanket assemblies in a configuration simulating a heterogeneous LMR core.

MISSION

- Demonstrate commercially competitive fuel system (3 year core) which could become operational in an inherently safe reactor in the 1995-2000 time period.
- Demonstrate the capability of an LMR (FFTF) to operate for extended periods at high capacity factors.
- Exploit the third generation cladding and duct materials (ferritic).

SCHEDULE

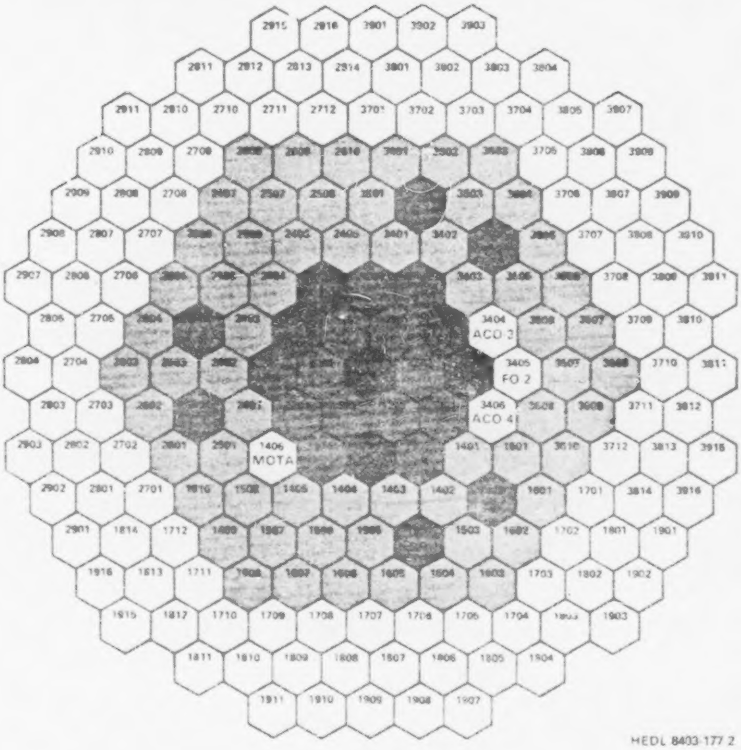
- Fuel fabrication was begun October 1984. Assembly fabrication is scheduled to begin September 1985 with completion of 10 fuel assemblies and 6 blanket assemblies by December 1985.
- Irradiation is scheduled to begin in FFTF Cycle 9, in second quarter of 1986.
- First assembly to be discharged for postirradiation examination at the end of FFTF Cycle 9, second quarter of 1987.
- Goal exposure will be reached at the end of FFTF Cycle 11 (late 1989, early 1990).

STATUS

- Design analyses are 85% complete.
- Fuel procurement and fabrication activities are on schedule.

ATTACHMENT 4

3-ROW CDE


3404
ACO 3
3405
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3406
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MOTA

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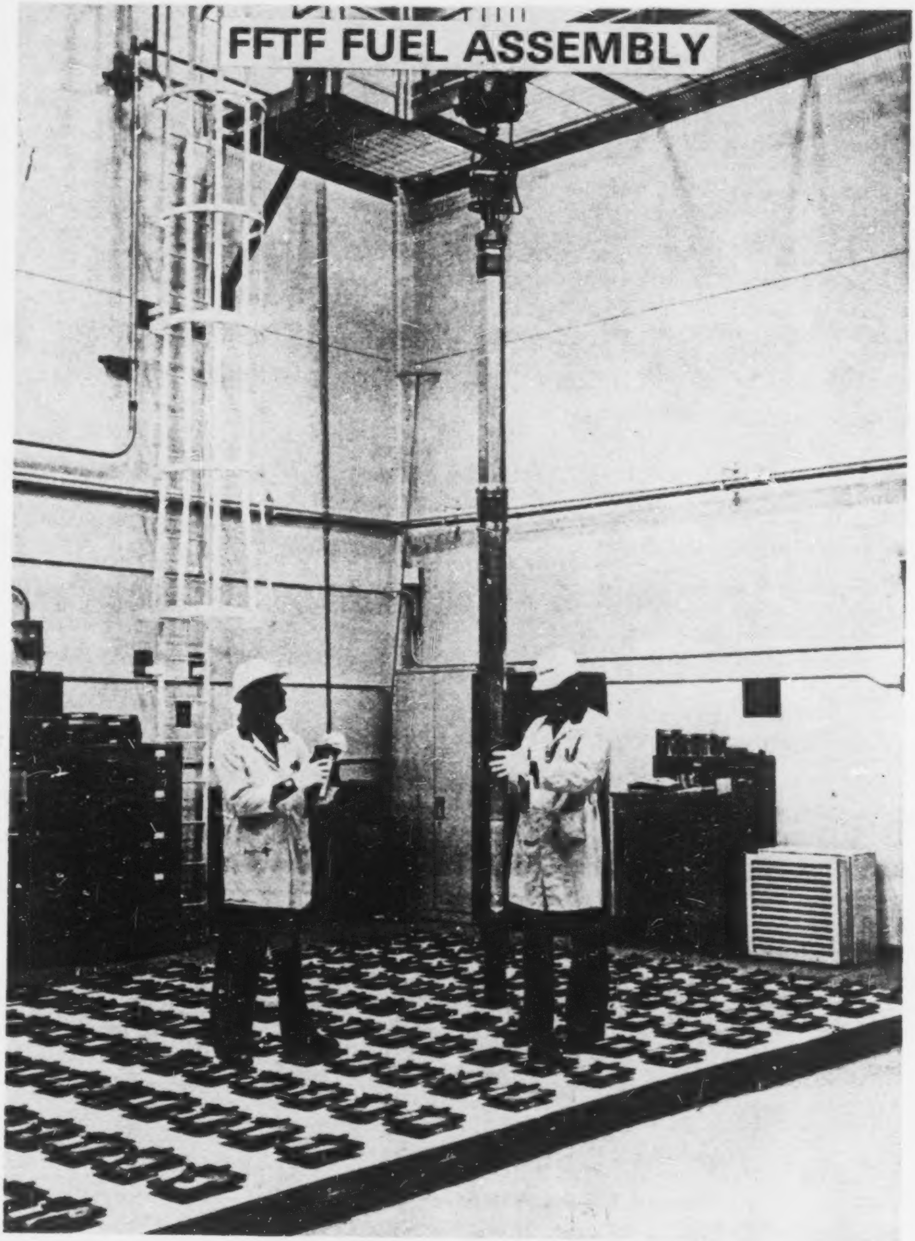

FFTF FUEL ASSEMBLY

ATTACHMENT 5

FUELS AND MATERIALS EXAMINATION FACILITY

BACKGROUND

- Authorized as line item in FY-78
- Design started January 1978
- Construction began December 1978
- Construction completed August 1984
- A Category 1 plutonium facility -- one-of-a-kind in U.S.

MISSION

- Provide fuel for the Fast Flux Test Facility using the Secure Automated Fabrication Line, Test Pin Line, and Fuel Assembly/Storage capabilities
- Provide proper storage for all Hanford Engineering Development Laboratory Special Nuclear Material (SNM)
- Demonstrate state-of-the-art safeguards and security for SNM
- Perform fuel fabrication for other plants as directed by DOE

OBJECTIVES

- FY-1985
    - Complete startup testing
    - Be ready to store Special Nuclear Material
- Long Range
    - Fully operational with SAF in August 1987
    - Attain alternate mission to utilize unique features, including the shielded process cells, support cells, decontamination and repair facilities

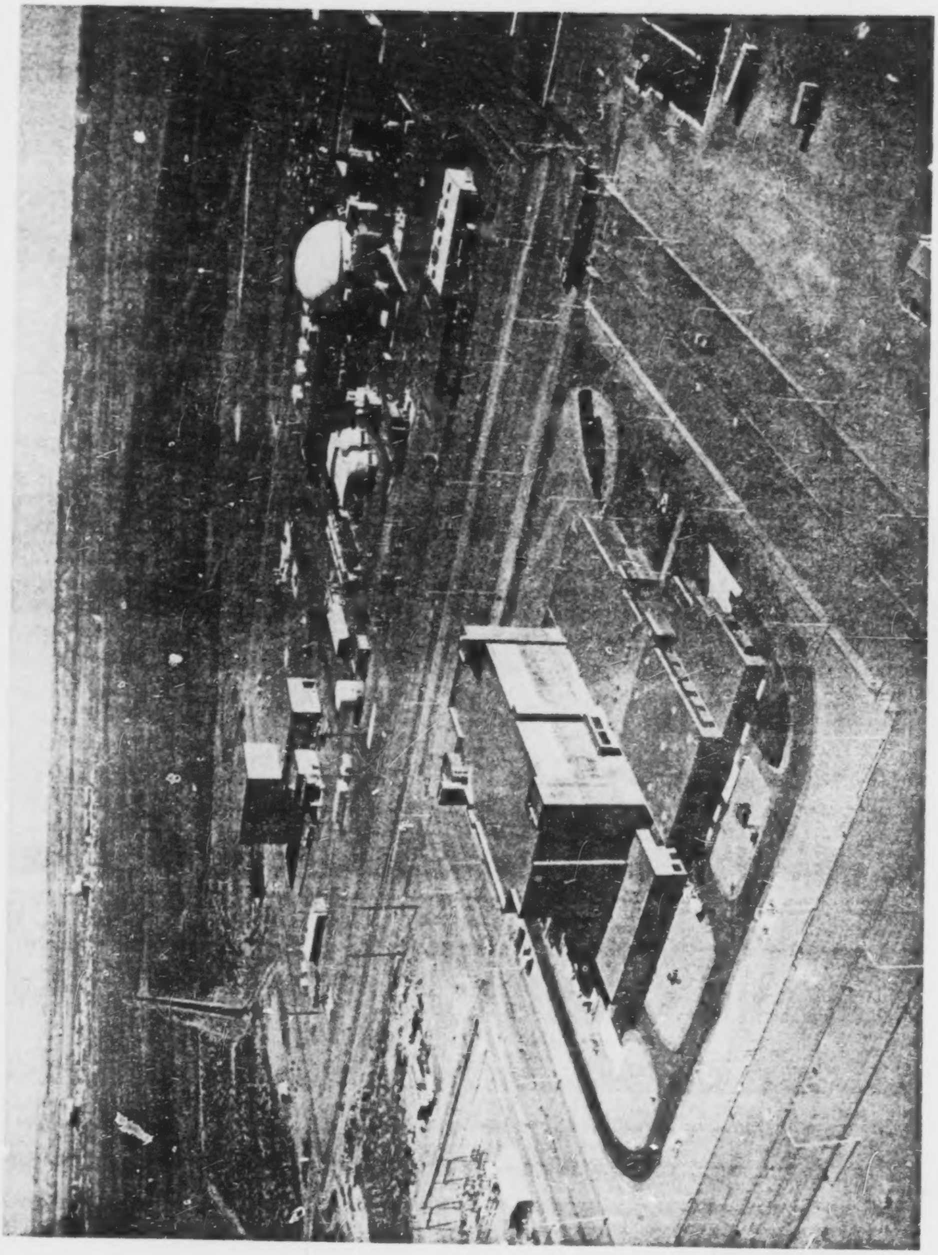
COST

- Capital Cost $174.9M for construction and startup
- $6.7M in reserve for alternate mission and/or settlement of claims

STATUS

- Facility startup testing - 55% complete
- Secure Automated Fabrication Line equipment installed - 35%

ATTACHMENT 5



ATTACHMENT 6

SECURE AUTOMATED FABRICATION LINE

SCOPE

- Fuel fabrication line being installed in the Fuels and Materials Examination Facility (FMEF) by Westinghouse Hanford Company at Hanford, Washington
- The Secure Automated Fabrication (SAF) line will fabricate completed fuel assemblies containing uranium/plutonium oxide for the Fast Flux Test Facility (FFTF) or other Liquid Metal Reactors (LMR)

MISSION

- Provides sole source of fuel reloads for FFTF
- Demonstrates remote/automated fuel fabrication technology needed for future LMR's
- Develops automation technology valuable to current U.S. industry
- Provides technology resource for international exchange including possible fabrication of fuel for MONJU reactor by 1990

OBJECTIVES

- FY-1985
  - Complete procurement of all process equipment
  - Complete 80% of SAF line installation in FMEF
- Long Range
  - Complete SAF installation in early 1986
  - Start plutonium/uranium fuel fabrication in 1987
  - Deliver FFTF fuel as needed in 1988
  - Remain able to expand mission to support second reactor at minimal incremental cost by 1989

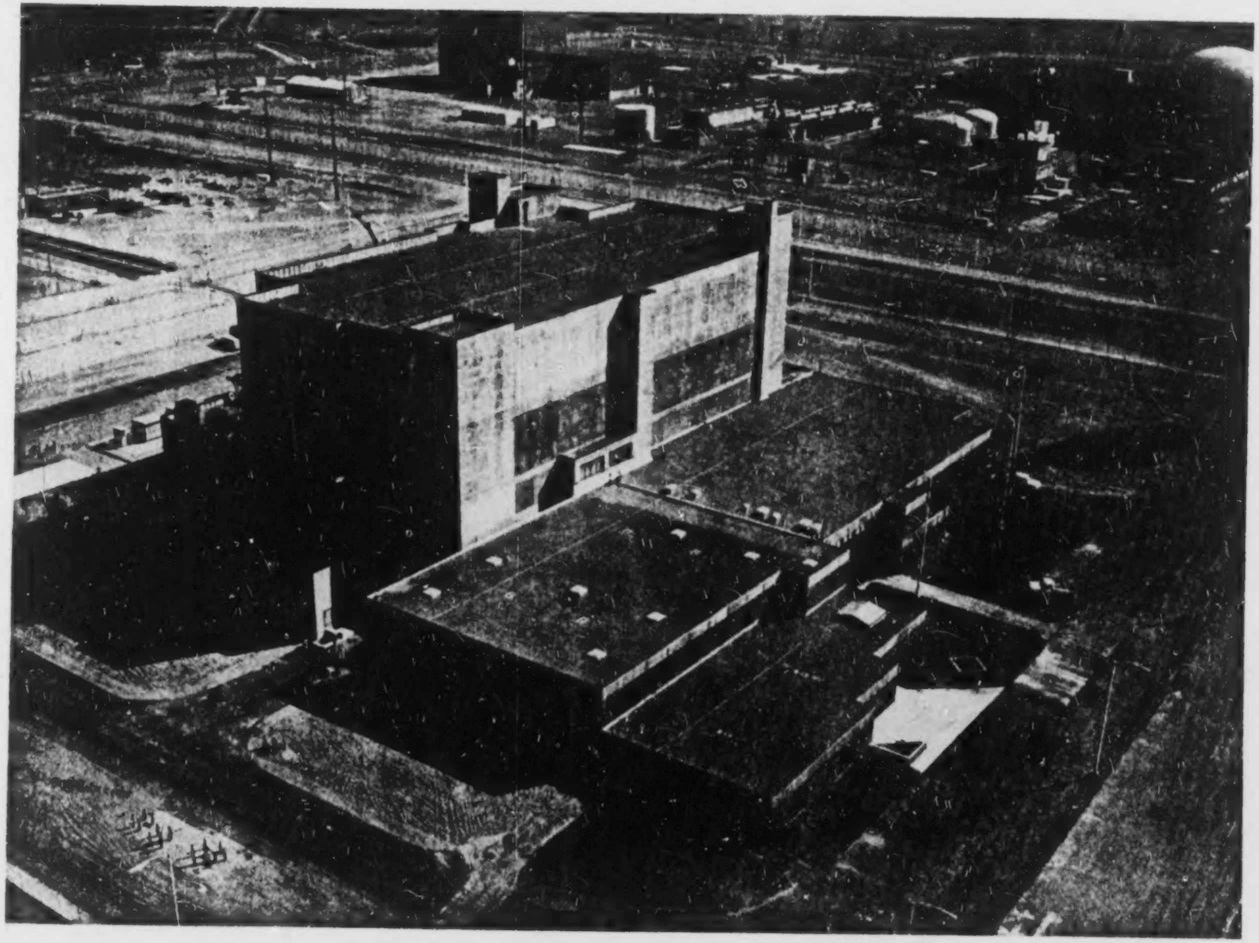
COST

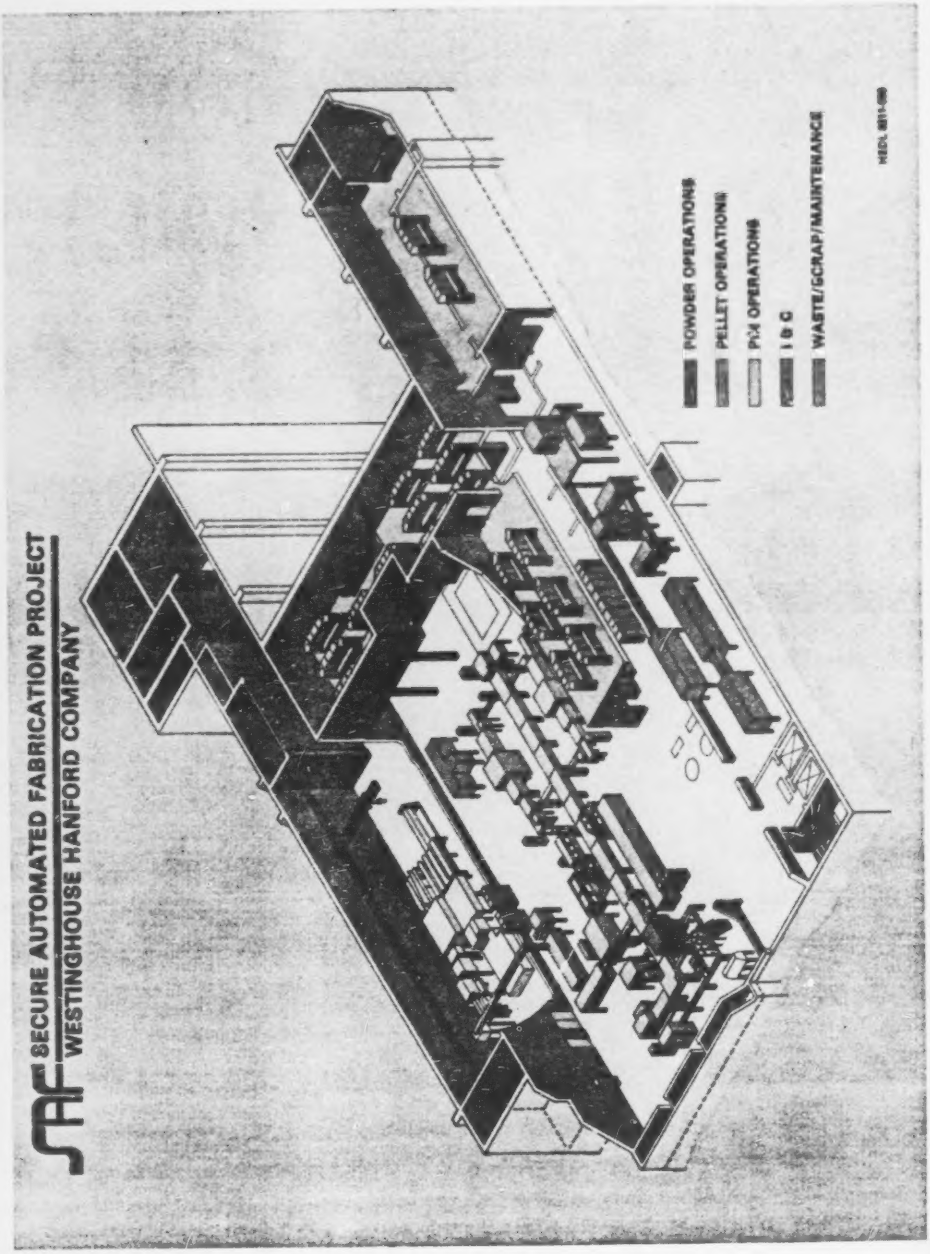
- $50.1M capital cost
- $43.1M budgeted through FY-1985

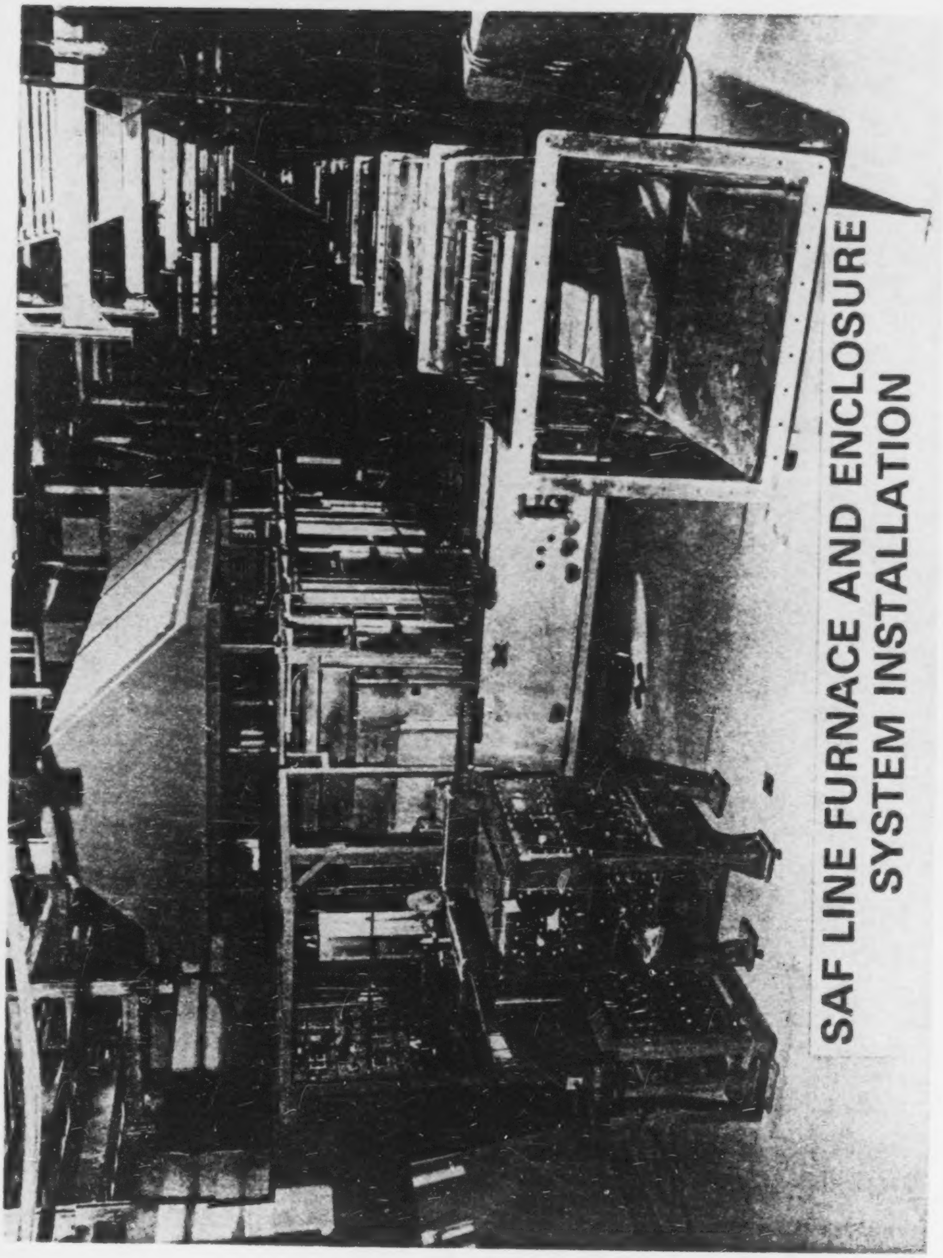
STATUS

- Project scope and schedule have been adjusted to meet current LMR program fuel supply and technology requirements
- Project proceeding on schedule consistent with 1985 and long-range objectives
  - 84% process equipment procured or delivered
  - 93% installation design complete
  - 35% installation complete

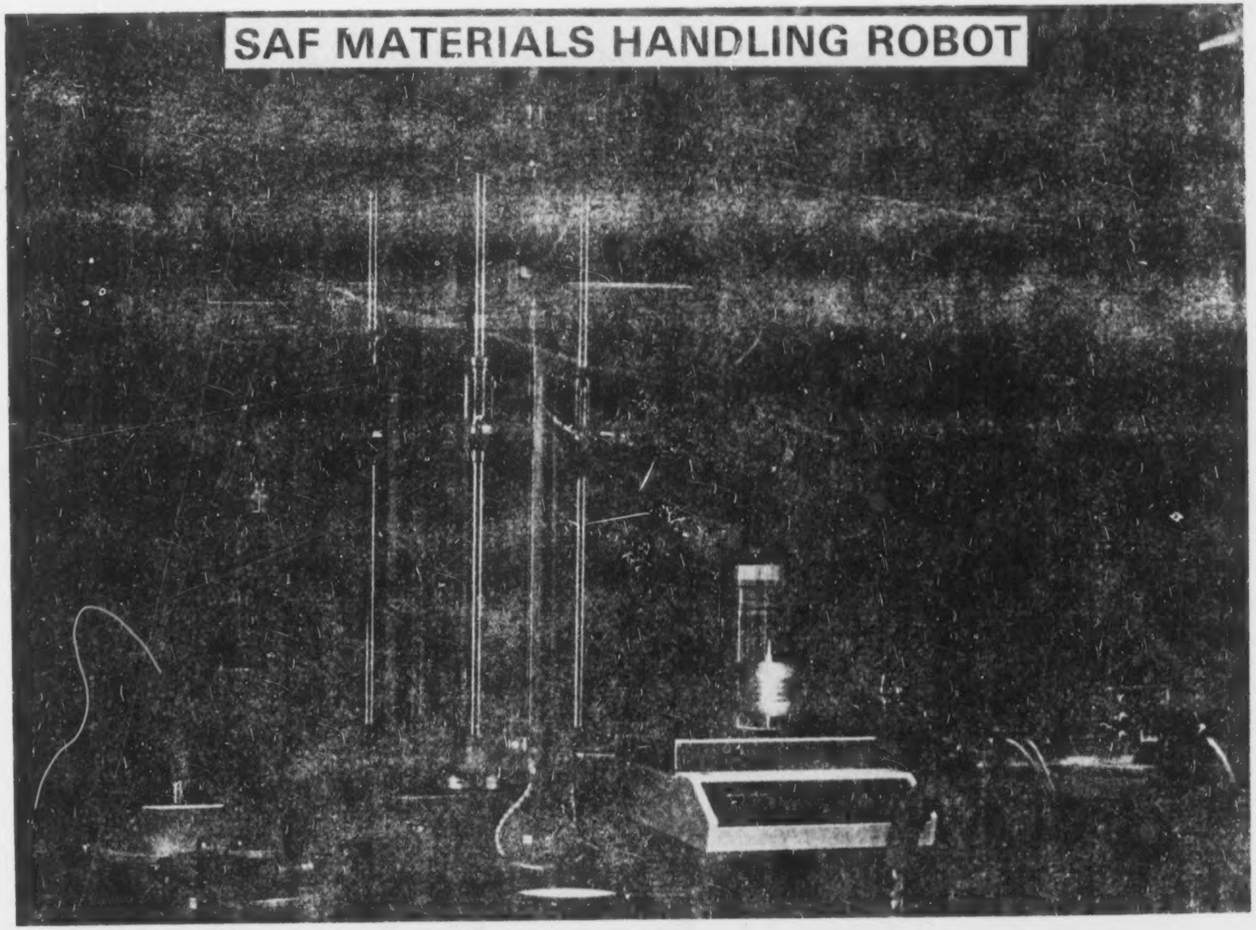
ATTACHMENT 6




SAF
SECURE AUTOMATED FABRICATION PROJECT
WESTINGHOUSE HANFORD COMPANY
POWDER OPERATIONS
PELLET OPERATIONS
PIN OPERATIONS
I & C
WASTE/SCRAP/MAINTENANCE
HEDL 8011-[illegible]



SAF LINE FURNACE AND ENCLOSURE SYSTEM INSTALLATION



SAF MATERIALS HANDLING ROBOT

ATTACHMENT 7

MATERIALS OPEN TEST ASSEMBLY (MOTA)

BACKGROUND

- World's most advanced test assembly for materials irradiation
- Versatile assembly provides irradiation volume for a variety of structural material specimens
- Temperature conditions can be closely controlled
- First irradiation began in 1983

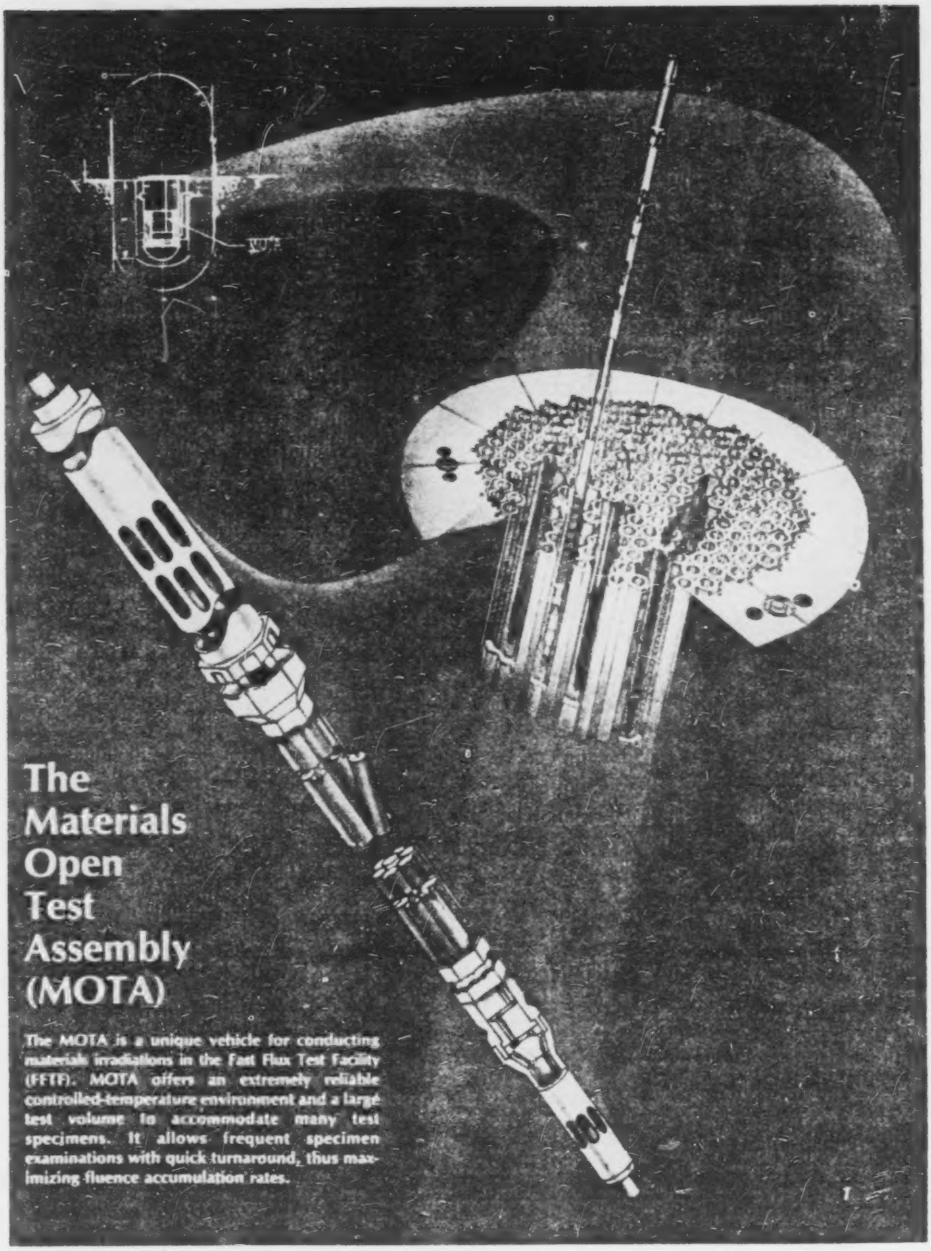
ADVANTAGES

- Unique computerized independent temperature control system regulates canister temperature to specified values ± 5°C from bulk coolant temperature to 750°C
- Large test volume in 48 canisters (4 liters)
- Wide variety and large number of specimens can be handled
- Precise time of in-reactor failure of pressurized tubes can be determined
- High rate of test data acquisition - rapid reconstitution of experimental packages during refueling periods

ACCOMPLISHMENTS

- Contributing to development of extra long life materials for LMR program
- Provides data for other U.S. programs; i.e., fusion, space reactors, and defense
- Supporting international program with Japanese
- Program successes leading to increased use by non-LMR customers

ATTACHMENT 7



The Materials Open Test Assembly (MOTA)

The MOTA is a unique vehicle for conducting materials irradiations in the Fast Flux Test Facility (FFTF). MOTA offers an extremely reliable controlled-temperature environment and a large test volume to accommodate many test specimens. It allows frequent specimen examinations with quick turnaround, thus maximizing fluence accumulation rates.

ATTACHMENT 8

ARTIFICIAL INTELLIGENCE APPLICATIONS

BACKGROUND

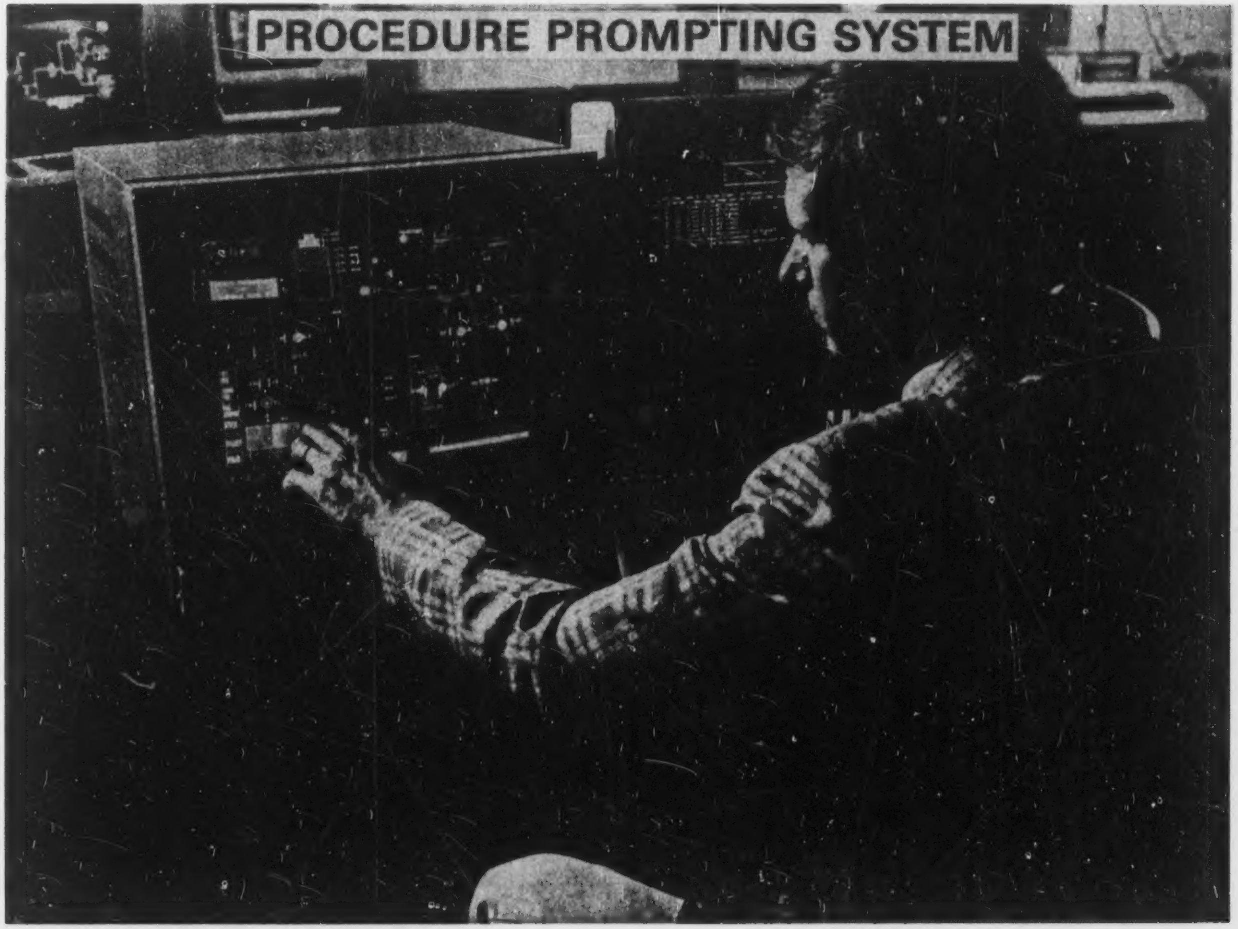
- Program started in 1980 for Department of Energy
- HEDL is lead national laboratory for advanced computer applications to the control of liquid metal reactors
- Present (FY-85) budget is $700K
- Emphasis is an application of automated reasoning systems to control and verification of nuclear plant operations

PRODUCTS

- The Procedure Generation System, developed in 1982, is a computerized system that can automatically synthesize procedures for control of nuclear plants during off-normal plant operation.
- An automated reasoning verifier was developed that is able to, on-line, verify the actions and logic of the Procedure Generation System. Its basic function is to monitor the logic decisions being made by the Procedure Generator and to voice an opinion as to whether or not the decisions or conclusions are correct. This artificial intelligence system shows great promise as a redundant, diverse on-line checker for many different areas of plant operation.
- An automated reasoning refueling assistant computer program was developed that has the ability to determine the type and sequence of moves that are necessary to refuel the core of the Fast Flux Test Facility, a liquid-metal cooled reactor.
- A Test Station was developed to accomplish detailed testing of newly-developed operator computer aids for plant control. This test station is electronically coupled to the Fast Flux Test Facility Simulator.

FUTURE WORK

- The development of a methodology for design and use of an integrated plant knowledge base is well underway. This work will provide a way to bring together in one form the relationships and knowledge that the plant designers intended for the overall plant. Artificial intelligence applications programs will use this as the source of plant knowledge.
- The objective of future work is to develop, demonstrate, test, and evaluate advanced control concepts applicable to next-generation nuclear reactors. Developed concepts will be installed both in simulators and in actual plant situations.


PROCEDURE PROMPTING SYSTEM

Mr. STALLINGS. Thank you, Mr. Nolan, and Dr. Arnold.

We're going to ask Dr. Till if he would testify next.

STATEMENT OF DR. CHARLES E. TILL, ASSOCIATE LABORATORY DIRECTOR, REACTOR RESEARCH AND DEVELOPMENT

Dr. TILL. Yes. Thank you very much, Mr. Stallings, and other members of the subcommittee. I am Charles Till, associate laboratory director of Argonne National Laboratory. I am responsible for the laboratory's Reactor Research and Development Program. I appreciate the invitation that was given to me by the committee to describe the status and the future plans of the Liquid Metal Reactor Program at Argonne and to share with the subcommittee my concerns about the effect of the budget that you are considering today.

In looking at the budget as a practical matter, the important thing is whether the total budget for LMR development, adding the advanced converter and the advanced breeder amounts together, adequately supports LMR development as a whole.

The basic directions in the budget toward new and innovative LMFBR concepts are undoubtedly correct, that the program must have an objective and that objective must be to bring an LMFBR concept that's sufficiently attractive in its characteristics to an early proven status.

The innovative designs of Rockwell and General Electric that we'll be hearing about today are good examples of the kinds of directions that are necessary. But the DOE Program itself must be structured to support the technology programs that are necessary to bring concepts like these to a proven status.

Argonne is the center for technology development of the nuclear portion of the LMR system. And no innovative design can be made a reality without developmental capability of this kind somewhere, and it is simply a fact that Argonne represents that capability today in this nation.

Like the National Program, the Argonne Program has two distinct parts. The R&D portion of the program, the so-called technology element, are the scientists and engineers who do the actual development work, and they're largely centered at our main site in Illinois. The other portion consists of our major test facilities which support the R&D that are located on the Argonne site in Idaho. Both are necessary for development to proceed.

In my written statement I have prepared a detailed description and status update of the work performed both at Argonne East and Argonne West, as requested by the subcommittee. And in response to a second request, I will now turn to our Integral Fast Reactor, or IFR Program.

The IFR Program began last year to develop an advanced LMR concept that could promise improved inherent safety characteristics, low capital cost, and economical fuel cycle closure.

At the request of the Department of Energy the University of Chicago last summer established a special committee of experts of the highest stature to conduct an independent review of the IFR concept, and I will just quote from their report which came out in October: "The IFR concept," the committee concluded, "offers many important benefits, and the scientific evidence on which the concept is based, although limited, is sound. It is strongly recommended that ANL move forward at a rapid pace to explore further the feasibility of the concept."

Argonne has been given approval by DOE to conduct a 2-year Feasibility Program, and we have moved very rapidly with work across the board. In fuel performance demonstration we have worked all the way across the board in characterizing the new IFR fuel. We've set up a fuel fabrication capability in Idaho. We've produced the first fuel. The three lead subassemblies will be going into EBR-2 either today or tomorrow—all this accomplished, as I say, in a period of 4 or 5 months.

In the new reprocessing scheme, the pyrometallurgical scheme, there are two aspects to that. The first is electro-refining; the second, halite slagging. The new part really is the electro-refining. That has been shown on the hundreds-of-gram level to be successful on uranium and simulated fission product mixtures, and we now have the capability set up to do the plutonium-based work over the next few months. By the end of summer we should have both steps demonstrated.

In safety the IFR concept has some unusual and unusually attractive safety characteristics, we believe. The first actual tests in reactor will be going on in TREAT in Idaho through March and April, and we will have the first results by the end of April.

As you can see, this program has moved very rapidly. It was only last year that I appeared before the committee urging the undertaking of the IFR.

In my written testimony I have also provided a table of the projected IFR Program costs, again as asked for by the subcommittee.

In addition to the IFR generic development work, the Argonne Technology Program is also deeply involved in supporting both the specific industrial innovative designs: The General Electric prism project and the Rockwell International SAFR project.

In summary, the Argonne nuclear systems capability both in R&D and in facilities, although squeezed over the years to half the size it once was, remains active and whole today. In fact, the opportunity to work on a generation, a new generation of reactors and, in particular, the IFR has made this program a highly motivated and enthusiastic one over the past year.

Further, I believe that the work that is being done at Argonne is acting as a focal point for activities leading to a new generation of liquid metal reactor concepts. The work on the IFR itself is proceeding rapidly, and the collaboration with the industrial firms on these specific designs, including the IFR concept option, we believe can also lead to real advances.

So at the moment, the picture is one of optimism and excitement. The future, though, as embodied in the DOE fiscal 1986 budget is quite different. The Argonne Reactor Development Program, including both the R&D portion and the facilities portion, totals about $70 million a year, $40 million of that to Idaho for the facilities, $30 million to Illinois for the R&D part.

Based on the information accompanying the DOE budget, the lab tables, it appears that the $70 million is to be cut to $53 million. And our understanding is that the preliminary allocation allots 44 of the 53 to facility operation, cuts the R&D from $30 million to $9 million.

Under these circumstances, the technology elements—the design, the analysis, the experiment development; quite simply, the entire Argonne R&D capability—will simply disappear. The development of the IFR would stop entirely. The support for the industrial innovative designs would also terminate. The programs that the facilities are used for would terminate. We can only assume that the operation of the facilities themselves, which are useful only in concert with the R&D, would also terminate within a short time and bring this program to a closeout position.

It's obvious I view this with extreme concern. In effect, the technology base in the U.S. for the nuclear systems development will have been dismantled. Nuclear systems technology went from $54.1 million nationally in fiscal 1984 to $36.5 million nationally in fiscal 1985, and although the precise amount can't be determined in the way the budget is laid out, it will go to some small fraction of this in fiscal 1986. And the implication seems obvious.

I deeply appreciate the opportunity you've given to me to present the program on my laboratory today, and I appreciate even more the opportunity to share my concerns with the implication of the fiscal 1986 budget on these programs and, therefore, on the Reactor Development Program for the Nation. Thank you very much.

[The prepared statement of Dr. Till follows:]

TESTIMONY

PRESENTED TO THE SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION OF THE COMMITTEE ON SCIENCE AND TECHNOLOGY U.S. HOUSE OF REPRESENTATIVES

February 21, 1985

CHARLES E. TILL

Associate Laboratory Director,
Reactor Research and Development

ARGONNE NATIONAL LABORATORY
9700 S. Cass Ave.
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Statement of

Associate Laboratory Director
Reactor Research and Development
Argonne National Laboratory

Before the

Subcommittee on Energy Research and Production
Committee on Science and Technology
U.S. House of Representatives

February 21, 1985

Madam Chairman, and Members of the Subcommittee, I am Charles Till, Associate Laboratory Director of Argonne National Laboratory, responsible for the Laboratory's Reactor Research and Development Program. I appreciate the opportunity to speak to the Subcommittee about the future course of liquid metal reactor development in the U.S. In particular, I appreciate the opportunity to comment on the directions implicit in the Department of Energy fiscal 1986 budget for the Liquid Metal Reactors Program, to describe the status of the Liquid Metal Reactor Development Program at Argonne National Laboratory, and, finally, to share with the Committee my concerns about the effect on the Liquid Metal Reactor Development Program of the budget you are considering today.

The division of the Liquid Metal Reactor program into two new budgetary categories, "Advanced Converter Reactors" and "Advanced Breeder Reactors," is useful to the degree it emphasizes that the LMR can be a near-term option similar to the other advanced converters. The superb operationing history of EBR-II over 20-years, the equally successful operation of FFTF since its commissioning, and the successful operation of foreign LMRs, particularly in France, demonstrate conclusively that LMRs can be built and operated successfully today. In considering the LMR in the context of other advanced converters, however, it is important to remember that the LMR is unique in that the very same reactor can be simply transformed from a converter to a breeder whenever it is necessary or desirable to do so, without the necessity for the nation to develop still another reactor type. In assessing national priorities between advanced converter reactor concepts, this fact should not be lost.

The matter of greatest practical importance is whether the total budget for LMR development, adding the "Advanced Converter" and "Advanced Breeder" amounts together, adequately supports the new directions to develop advanced LMR concepts that promise better inherent safety, lower capital costs and economic fuel cycle closure. To do this, adequate support is needed for both what are called "Technology Elements" in the current years budget -- basically the R&D portion -- and the Facilities, which are used in the R&D. It is my fear that the effect of the new budgetary categorizations, for reasons I will go into in a moment, may be to largely terminate the R&D, and bring the actual development program to a close-out position.

The basic directions toward new and innovative LMR concepts implicit in the FY 1986 budget, are undoubtedly correct. The objective of the program must be to bring to bring an LMR concept of this kind, sufficiently attractive in its characteristics, to an early proven status. The innovative designs of Rockwell International and General Electric, funded by the Department this year, are good examples of the directions that are necessary. But the DOE program itself must be structured to support the technology programs that are necessary to bring such concepts to a proven status.

The Argonne National Laboratory Reactor Development Program has moved rapidly in the last year or two to reorient its programs to this goal. Argonne has a rather unique place in the overall national LMR program, in that it is the center for technology development of the entire nuclear portion of the LMR system. Neutronics, thermal-hydraulics, mechanical analyses, safety design, metallurgy, chemistry -- all combine to make up a total capability that can be directed as a single unit to the development of a new reactor type. No innovative design, or new reactor type, could be made a reality without capability of this kind. Portions of similar capability exist elsewhere, but it is a fact that Argonne is the major national capability, and in many areas the only such capability, for development of the nuclear portion of any new LMR concept. Dedication of the Argonne capability to the new concepts is necessary if such concepts are to move from the paper stage.

Like the national program, the Argonne program has two distinct parts. The R&D portion of the Argonne program -- the so-called Technology Elements -- are Ph.D-level scientists and engineers who do the actual development work, and are largely centered on our main site in Illinois. The other portion consists of our major test facilities, which support the R&D, located on the Argonne site at the Idaho National Engineering Laboratory. Both are necessary. The facilities cannot advance development without the R&D to utilize them, and the R&D cannot be tested without the facilities.

Madam Chairman, as you requested, in my written statement I have provided a detailed description, evaluation and status update of the work performed both at ANL-East in Illinois and ANL-West on our Idaho site. And in response to your second request, I will now turn to our Integral Fast Reactor, or IFR, program.

The IFR development program was initiated in the latter part of FY 1984, based on an ANL initiative to develop an advanced LMR concept that could promise sharply improved inherent safety characteristics, low capital cost, and economic fuel cycle closure. The IFR is a generic reactor concept, not a specific design. The concept is based on a few, basically four, technical features. These technical features give it a set of characteristics that at the very least are desirable for any nuclear reactor for the future. The four basic features are: (1) Liquid sodium cooling, (2) pool-type reactor configuration, (3) metallic-fuel core design, and (4) an integral fuel cycle with a colocated fuel cycle facility, based on pyrometallurgical reprocessing and injection-cast fuel fabrication.

The IFR concept has a number of specific technical advantages that collectively address the potential difficulties facing the Liquid Metal Reactor today. These advantages are in the areas of fuel performance, fabrication, reprocessing, safety, economics, waste, transportation, diversion and theft, and flexibility in plant size and deployment strategy.

At the request of the Department of Energy, The University of Chicago last summer established a Special Committee of experts of the highest international stature to conduct an independent technical peer review of the IFR concept. The Committee completed its initial review and issued its report in October 1984. The Committees concluded that:

- "The IFR concept offers many important benefits, and
- The scientific evidence on which the present concept is based, although limited, is sound.

It is strongly recommended that ANL move forward at a rapid pace to explore further the feasibility of the concept."

Argonne has been given approval by the Department of Energy to conduct a two-year IFR feasibility R&D program. The objective of the two-year program is to establish the basic concept feasibility by the end of FY 1986. Technical feasibility is to be shown in the necessary three key technical areas; fuel performance, pyrometallurgical process development, and establishment of the basic safety characteristics. In addition, the potential of the concept is to be quantified for ultimate economics and inherent safety advantages in conjunction with the ongoing industrial innovative designs.

a. **Fuel Performance Demonstration:** Work is proceeding across the board to establish the compatibility of the IFR fuel with advanced cladding materials, to characterize the distribution of alloying elements within the fuel, to measure the thermal and physical properties of the fuel, and to establish methods for calculating the fuel behavior. An IFR fuel fabrication facility has already been constructed and put into operation. The three lead IFR-fueled subassemblies have been fabricated and are being loaded into EBR-II at the present time, and an FFTF lead test plan is proceeding on schedule.

b. **Pryrometallurgical Process Development:** The concept uses a revolutionary new reprocessing technique that promises substantial advantages in cost, simplicity, and deployment flexibility. The major process steps are electrorefining, which will be used for the core material and halide slagging, which will be used for the blanket. The work to establish that product yields will be adequate, fission product removal will be sufficient, container materials and process reagents can be specified and will perform as expected, and that the processes are adaptable to remote operations, is all underway.

The first electrorefining experiments on a mixture of uranium and simulated fission products have already been successfully completed. Plutonium based electrorefining and halide slagging work will start momentarily, as the construction of the necessary glovebox facilities is nearing completion. At the end of this development, the process would be a reality, on very close to practical scale.

c. **Demonstration of Safety Characteristics:** The new metallic fuel promises sharply improved inherent safety characteristics due to unusual properties of the fuel itself. Work is underway to provide the experimental data to validate the unique inherent safety features and fully characterize the totality of safety features associated with IFR fuel, through detailed analysis, calculational modeling, TREAT in-pile test, and out-of-pile experiments. The TREAT test preparations are progressing on schedule and completion of the first three tests is expected by the end of April.

Madam Chairman, as you can see, this program has moved very rapidly from the point just a year ago when I appeared before you to recommend that development of the IFR should be undertaken. The feasibility demonstration will be complete at the end of FY 1986.

The next step is to demonstrate the practicality of the entire Integral Fuel Cycle using the EBR-II complex and the refurbished HFEF/South facility. These facilities are already in place. The HFEF/South facility has been decontaminated, ready for the new equipment. The total cost is expected to be very modest. The facility upgrade and modifications are estimated to cost $12.2 million and the equipment $3.0 million. As you requested, I have included in my written statement a table that shows the total IFR program projected costs. The cumulative total costs over the five-year are now estimated to be $94 million. At that point EBR-II will be in full operation as an IFR prototype, with a closed fuel cycle, demonstrating all aspects of the IFR concept. As the IFR program rests upon the technical expertise and the necessary test facilities within the ANL base program, the cost estimate shown on the table assume continued funding support of the ANL facilities and technology development at the FY 1985 level.

In addition to the IFR generic concept development work, the ANL technology program is also deeply involved in supporting the development of the specific industrial innovative designs -- the General Electric PRISM project and the Rockwell International SAFR project. The Argonne National Laboratory involvement in these projects is of a rather unique kind within the national laboratory system and is simply due to the breadth of Argonne capability in nuclear systems technology. Argonne is both an active participant in the design development, and a source of feature development and testing for the new features of the designs. Such technology development and analyses capabilities are crucial to move these, or other new reactor designs, from the paper stage to practical reality.

Madam Chairman, I have attempted to describe the Argonne Reactor program content, its goals and its current status. In summary, the Argonne nuclear systems technology development capability, both in R&D activity and facilities, although squeezed by budgetary stringencies over the years to half the size it once was, remains active and whole. In fact, the opportunity to work on a new generation of reactors, and in particular, the IFR, has made the program a highly motivated one over the past year. Further, I believe that the work being done at Argonne is causing some desirable rethinking across the program as a whole, and is acting as a focal point for activities leading to a new generation of liquid metal cooled reactor concepts. The work on the IFR concept itself is proceeding very rapidly. The collaboration with the industrial firms on developing specific designs, including the IFR concept option, is also work that we see as challenging and worthwhile and that can lead to real advances in the reactor field. So at the moment, the picture is one of optimism and excitement.

The future, however, as embodied in the Department of Energy FY 1986 budget appears to be very different. The Argonne Reactor Development Program, including both the R&D portion and the facilities, totals about $70 million in operating funds annually. Of this, about $40 million is used to support the facilities at Argonne-West, $30 million for the R&D elements that are largely centered at Argonne-Illinois. Based on the information in the Laboratory tables accompanying the Department of Energy's FY 1986 budget it appears that the total budget is to be cut from $70 million to $53 million. Further, it is our understanding that the preliminary allocation allots $44 million of the $53 million to Facility operation, and cuts the R&D from $30 million to $9 million. Under these circumstances, the Technology Elements -- the design, analysis and experiment development, quite simply the entire R&D capability, would simply disappear. The development of the IFR would stop entirely. The support for the industrial innovative designs would also terminate. The programs that the facilities are used for would also terminate. We can only assume that the operation of the facilities themselves, which are useful only in concert with the R&D, would also terminate within a short time and bring the program to a close out position.

It is obvious that I view this with extreme concern. In effect, the technology base in the U.S. for nuclear systems development will have been dismantled. Nuclear Systems Technology went from $54.1 million nationally in FY 1984 to $36.5 million nationally in FY 1985 and, although the precise amount cannot be determined in the way the budget is laid out, it will go to some small fraction of this in FY 1986. The implication seems obvious.

Madam Chairman, I deeply appreciate the opportunity given to me to present the program of my Laboratory today, and I appreciate even more the opportunity to share my concerns as to the implications of the FY 1986 budget on these programs, and on the resulting reactor development program for the nation. Thank you.

ARGONNE NATIONAL LABORATORY
LIQUID METAL REACTOR DEVELOPMENT PROGRAM

Comments, Description, Evaluation and Status Update

CHARLES E. TILL
Associate Laboratory Director
Reactor Research and Development
Argonne National Laboratory

A report supplementing testimony before the
Subcommittee on Energy Research and Production
Committee on Science and Technology
U.S. House of Representatives

February 21, 1985

The division this year of the Liquid Metal Fast Reactor Development Program into two new budgetary categories, "Advanced Converter Reactor" and "Advanced Breeder Reactor," is new to the FY 1986 budget; all such work in FY 1985 is covered under the single category "LMFBR Base Program Technology." Grouping the Liquid Metal Reactor (LMR) with other advanced converter concepts is useful in that it emphasizes that the liquid metal system need not be relegated to some distant time frame but, rather, is a near term option like the others in this category. The liquid metal cooled reactor has been shown by years of actual operation to be a reality at the present time, and should be thought of in this way. Twenty years of highly successful operation of EBR-II in Idaho, the equally successful operation of FFTF at Hanford, and the successful operation of foreign liquid metal reactors, particularly in France, make this an indisputable fact -- although not always understood or appreciated. It is true that the precise kind of LMR system that best capitalizes on the inherent properties and advantages of the liquid metal cooled system is being re-examined at the present time. But it is also true that the LMR, in any of its forms, differs from the other advanced converter concepts in a fundamental way, and in an important regard is unique: Once the LMR is developed as an advanced converter, the same basic reactor can be transformed into a breeder, when and if a breeder is required, without the necessity for developing still another reactor type. In assessing priorities, this fact should not be lost.

The matter of greatest practical importance in examining the new budgetary characterization is whether the Liquid Metal Reactor Program as a whole, adding together both the "Advanced Converter", and "Advanced Breeder" portions, continues to adequately support the elements of the program necessary to allow the LMR concept to be successfully developed. As far as the technology to be developed is concerned, there is little or no distinction to be made between the "Advanced Converter" LMR and the "Advanced Breeder." Both require two basic program elements: First, the R&D elements, called "Technology Elements" in the FY 1985 budget, such as Nuclear Systems Technology, Power Conversion Technology, etc.; Second, facilities which support the R&D (the ANL facilities in Idaho, the FFTF facilities at Hanford, and ETEC at Rockwell International in California). It should be a cause for extraordinary concern if the effect of the new budgetary characterization was to further reduce the funding for the Technology Elements to the point where the R&D required for any real advance must terminate. Under these circumstances, operation of the facilities alone, even if adequately funded, would contribute little to further development.

On the positive side, the basic directions toward new and innovative breeder concepts implicit in the FY 1986 budget are undoubtedly correct. While it could be argued that we already have a sufficiently attractive and proven breeder system and that the only blocks are institutional, there are good reasons to conclude that the traditional breeder concept is not likely to be adequate and that most of the original assumptions that underlay its selection no longer hold true. Fundamental changes and improvements are possible within the technology, and they are likely to be necessary before the breeder becomes sufficiently attractive to become a real option for the nation. The innovative designs of Rockwell International and General Electric that have been funded by the Department of Energy this year are good examples of the kinds of changes in thinking that are necessary. It is also true, however, that the breeder program still does not appear to have a specific, easily understood, and simply articulated objective. The real objective of the program must be to make the LMR a practical option for this country -- to quickly bring a well-defined LMR concept to a proven status. It must be sufficiently attractive in its characteristics to cause the private sector to proceed with its implementation. That is, not only must the concept be sufficiently proven to confidently allow its construction and operation, but it must possess characteristics that make it attractive to do so. The DOE program must be structured to support the necessary technology development programs to bring a such a concept to this status at an early time. Only in this way can there be confidence that the private sector could move rapidly and decisively toward meeting the National need when such a reactor is required.

The Argonne National Laboratory Reactor Development Program has moved rapidly to reorient its programs in the last year or two toward just this goal. Real progress has been made. It is important to understand that Argonne occupies a rather unique place in the overall national LMR development program. Argonne is the center for technology development of the entire nuclear portion of the reactor system. Neutronics, thermal hydraulics, mechanical analyses, safety design, meturallurgy, chemistry, combine to make up a total capability that can directed as a coherent unit to development of a new reactor type. Although portions of similar capability exist elsewhere, it is a fact that Argonne represents the major National capability, and in many areas the only National capability, for the development of the nuclear part of any new liquid metal cooled system. This capability consists of Ph.D level scientists and engineers who, with others, conceive possible advances, develop the techniques for analyzing them, assess the data required, do the experiments to acquire the necessary data, analyze the experiments to prove the technology, so that, finally, improved reactor types can become a reality. No innovative design or new reactor type could become a reality without capability of this kind. Dedication of the Argonne National Laboratory capability to new and innovative advanced concepts is therefore necessary if such concepts are to move beyond paper studies.

To provide an understanding of the nature of the Argonne work on the programs now underway, the makeup of the Argonne capability will be first be described, and then the activities on each of the new concepts that utilize this capability will be described. Put simply, the concepts represent the goals of the program; progress toward these goals results from the capability being described.

Description of the Argonne National Laboratory Reactor Development Capability

At the heart of any truly new reactor concept is the reactor core and its associated fuel cycle. The ANL technology development activities focus on this and closely related areas. The major part of these activities are funded under the title "Nuclear Systems Technology" in the current year's budget. Each Argonne activity below (the title of which is underlined) is a separate and substantial R&D area, and each is generally unique to ANL. Taken together they represent the only such National capability for Nuclear Systems Technology development.

Central to any reactor system is Core Design Development. A new core design requires, first, and most obviously, establishing its neutronics, thermal hydraulic and mechanical behavior, and less obviously, appropriate choice of the reactor core materials and configuration to optimize its behavior and characteristics. Many trade-offs between conflicting requirements are necessary, each the result of complex calculation, assessment, and judgment. The validity of the design rests on the accuracy of the underlying experimental data, the accuracy of the calculational techniques, and the skill and insight of the assessments and judgments that go into the final selection of design.

Critical Experiments are actual experimental mockups of the new design. They provide the experimental data to validate the neutronics of the core. It is almost certainly true that no new reactor type has ever been built without critical experiments. The U.S. has eliminated most of its critical experiment capability. Only ZPPR at Argonne remains. In addition to the facility itself, personnel trained in the performance of both the experiments and the required analyses are part of the capability.

Core Design Calculational Methods development activities improve calculational accuracies. Two main activities are carried out. The first is to maintain and adapt existing methodology to new designs, and to new needs of designers, including assistance and training for new users. The second is to develop methodology that takes advantage of the tremendous growth in computer power, so that the capability is not frozen in the computer technology of years ago.

Extending out from the core itself is the whole of the primary system. Its characteristics are driven by the behavior of the core. Its properties determine how safe and operable the reactor is -- how the reactor system responds to transients, both expected and unexpected.

The Transient and Accident Analyses activity deals with developing calculational methods and computer codes specifically for transient analyses. They are the tools required to calculate the behavior of the full reactor system to optimize its design for safety and operability, and, as such, are the basis for design to maximize inherent and passive safety. Development and improvement of these codes and models is a substantial element of the R&D program. Such codes bring together in usable form the state-of-the-art in safety-related information required for design. However, the essential product lies not only, or even primarily, in the computer codes themselves, but rather in the depth of validation of the entire system of calculational methods by actual experiments and tests. Such experiments and tests are of two kinds:

First is the program of tests and experiments that provide data on specific facets of reactor behavior, usually done most inexpensively and effectively away from the reactor, and for that reason, they are called Out-of-pile Experiments. Examples are experiments to quantify fuel expansion during transients (important as a reactivity removal mechanism in assessment of inherent safety), sodium boiling in a large pin bundles (important in establishing the potential positive reactivity effects from this source), and heat transfer from the surface of a reactor vessel to an air stream (important in some decay heat removal system concepts).

The other kind of experiments must be done under actual reactor test conditions, and therefore are referred to as the In-pile Experiments. The primary facility is Argonne's TREAT reactor. The experiments in TREAT are analyzed and interpreted for computer code validation and impact on design. The experiments range from the simulation of slightly abnormal conditions to the simulation of severe accidents. Important to all innovative designs, they are particularly important to concepts utilizing a new fuel type with improved safety characteristics, like Argonne's Integral Fast Reactor concept.

Thermal-Hydraulics state-of-the-art calculations are required in most of the foregoing activities and such techniques are developed and applied in the core design development activities, in the transient and accident analyses activities, and as a separate developmental activity to allow realistic full 3-dimensional analysis of the flowing sodium systems.

Structural Mechanics analyses are required to establish the mechanical behavior of the reactor system under normal conditions, and under transients from the most minor to the most extreme. Seismic response is of particular concern. The ANL structural mechanics development group develop and validate the appropriate methodology and codes, and carry out the required analyses. This activity is at the center of much of the work now aimed at simplifying reactor systems, reducing costs, and improving the inherent safety of liquid metal reactors.

Taken together, this collection of activities gives the development capability required for the whole of the nuclear system. This, combined with the ANL capability in Components Technology, in fuels and materials in Argonne's Materials Science Division, and in chemical reprocessing and physical properties measurements in the Chemical Technology Division, gives the correct picture of the complete reactor development capability that exists at Argonne.

The Argonne National Laboratory Test Facilities at ANL-West

Argonne's major test facilities are located on the Idaho National Engineering Laboratory (INEL) site. They are a complete set of facilities that provide all the necessary capability for testing and development of nuclear systems technology for advanced liquid metal cooled reactors. EBR-II, a complete prototype LMR power plant, provides the test environment for fuels development, whole-system operational tests, and experience in liquid metal cooled reactor operation. TREAT, a specially design transient reactor, simulates LMR accident situations, and provides the necessary capability to test various facets of the safety performance of new reactors. ZPPR, a low power critical experiment facility, mocks-up the complete core of new reactor designs. HFEF, a hot fuel examination facility, allows the examination of highly radioactive fuels and materials experiments from TREAT and EBR-II, as well as FFTF, and provides the capability for collecting the required data from the experiments. Taken together, they satisfy the facility needs for establishing the nuclear system performance of any new sodium cooled reactor design.

EBR-II was the first pool-type fast reactor built in the world. It produces about 20 MWe of electrical power. The EBR-II experimental and testing capabilities allow many and varied irradiation environments, including instrumented in-core facilities, prolonged irradiation of experimental fuels beyond breach of cladding, transient overpower or transient under-cooled operation of experimental fuels, testing of plant response to upset conditions (e.g., loss of coolant flow), and testing of experimental LMR components in the various systems of EBR-II. The operating performance of EBR-II has demonstrated the extreme reliability and maintainability of an LMR power plant. Despite frequent shutdowns to conduct diverse experimental programs, during the last ten years the plant availability and capacity factors averaged 73.0% and 70.1%, respectively. As a steady-state irradiation facility, EBR-II has irradiated nearly 12,000 individual items (fuel pins, capsules, etc.) since 1965. The future utilization of EBR-II includes completion of the current U.S.-Japanese program of oxide fuel performance testing, completion of the current shutdown heat removal testing program, and increasing emphasis on EBR-II support of the IFR Program. IFR prototypic plutonium-bearing metal fuel is being loaded into EBR-II for irradiation this month, and plans for a full-scale IFR closed fuel cycle demonstration are being prepared.

The TREAT reactor has long provided accident-simulating transient irradiations for a wide variety of LMR fuels. Hundreds of experiments have been performed with oxide fuels, under various conditions, from unirradiated to highly irradiated end-of-life conditions. Experiments have ranged from those causing only limited fuel cladding strain to massive disruption and dispersal of fuel. Fuel-motion monitoring under accident conditons is measured as it happens, with a fast neutron hodoscope that allows identification of the time and location of fuel motion. The results support computer code validation, reactor safety analysis approvals, and a variety of studies to answer specific safety-related questions. A current upgrade activity provides a new reactor control and safety system in 1985 as well as the capability to irradiate larger, more prototypical, fuel assemblies under more prototypic thermal-hydraulic and neutronic conditions. The next TREAT tests are directed at verifying postulated IFR metal fuel safety characteristics.

The Hot Fuel Examination Facility (HFEF) consists of two individual facilities. The HFEF/South facility, originally constructed to develop and demonstrate remote reprocessing of uranium metal fuels and refabrication of EBR-II driver-fuel assemblies on a production-line basis, is now partly used to service EBR-II, but the main part of the facility is now clean and ready for modification for IFR recycle work. The HFEF/North facility, the newer facility, is in constant use for postirradiation examination of irradiated components and experiments. HFEF has performed pretest and post-test handling and examinations for virtually all the experiments in TREAT for the LMFBR safety program, for both FFTF and EBR-II experimental irradiations programs for development of fast breeder reactor fuels and materials, and also has provided post-irradiation examinations and other hot-cell services for other, non-LMFBR DOE programs including PBF, LOFT, LWBR, and others. HFEF will continue to provide post-irradiation examination capability for fuels and materials irradiation programs and for the TREAT safety experiments.

The ZPPR facilities provides integral reactor physics data for the U.S. LMR Development Program. Many reactors have been built and tested in ZPPR to support the design and licensing of major LMR projects. ZPPR data provides the benchmark tests for all LMR neutronics code development. Concept development and detailed design support, as well as detailed licensing support for the final design, were provided for the CRBR. Cores for larger, follow-on design concepts have been assembled and tested. This includes the international cooperative program (JUPITER) with Japan. Over the next few years, the ZPPR facility will be used to mock-up the LMR cores in DOE's Advanced Concepts Program. Benchmark experiments on the IFR metallic-fueled cores will begin in early spring. Another planned Japanese cooperative program starts in 1986 to test advanced design concepts of interest to both countries.

The Integral Fast Reactor (IFR) Program

The IFR development program was initiated in the latter part of FY 1984, based on an ANL initiative to develop an advanced LMR concept that could promise sharply improved inherent safety characteristics, low capital cost, and economic fuel cycle closure. The IFR is a generic reactor concept, not a specific design. The concept is based on a few, basically four, technical features. These technical features give it a set of characteristics that at the very least are desirable for any nuclear reactor for the future. The four basic features are: (1) liquid sodium cooling, (2) pool-type reactor configuration, (3) metallic fuel, and (4) an integral fuel cycle with a colocated fuel cycle facility, based on pyrometallurgical reprocessing and injection-cast fuel fabrication.

There is reason to distinguish between the IFR as a generic reactor concept, on one hand, and specific reactor designs, on the other. Particular designs of the IFR can be quite different in size, configuration, etc., but the basic technical features and the characteristics that follow from them are what characterizes the IFR. An analogy can be drawn to the PWR. Westinghouse, Combustion Engineering, and B&W design different PWRs but the basic features of a PWR -- high pressure water cooling, oxide fuel, loop-type reactor configuration -- are what specifies the generic concept, and the basic characteristics of the reactor system follow directly from them. At the present time, Rockwell International and General Electric are formulating specific innovative breeder designs. Options in one or both may be versions of the IFR. A question asked is "Are they designing the IFR?" The answer is that if the design has the four basic features, sodium cooling, pool configuration, metallic fuel and pyroreprocessing, then their design is a version of an IFR. The Argonne IFR responsibility is to establish the practicality of the basic features and characteristics, and carry out the development work that is needed, from which a specific IFR design, or designs, will evolve.

The IFR concept has a number of specific technical advantages that collectively address the potential difficulties facing the LMR today. These advantages are in the areas of fuel performance, fabrication, reprocessing, safety, economics, waste, transportation, diversion and theft resistance, and flexibility in plant size and deployment strategy.

The potential features and advantages of the IFR are the following:

1. The system has excellent fuel performance. Metal fuels have now been developed to allow extremely high burnups, at least as high as oxide fuel. Metal fuel was the original choice in early reactor development and has a strong neutronic advantage over oxide fuel. The reason it was supplanted by oxide fuel many years ago was at that time metal fuel could only achieve a low burnup, approximately 1%.

2. The IFR metal fuel is extremely easy to fabricate. The injection casting technique used for EBR-II fuel for many years produces fuel pins in a process far simpler and more direct than that used to produce pelletized oxide fuel.

3. Reprocessing techniques involving pyrometallurgy and electrorefining can remotely, quickly, and simply reprocess the fuel. This process is much smaller and simpler than the standard Purex process used for oxide fuel.

4. The metal fuel promises a much higher degree of inherent safety, with better safety characteristics all across the board from normal behavior all the way to postulated severe accidents.

5. The IFR economics, both the plant capital cost and the fuel cycle cost, are expected to be in the LWR range, and significantly better than for other LMR choices.

6. The amount of radioactive waste is minimal and can be easily managed.

7. Because the fuel is always highly radioactive during reprocessing and refabrication and never leaves the nuclear plant, the problem in transportation of radioactive material over significant distances never arises.

8. Because of the above features, the IFR also has very strong theft and diversion-proof characteristics.

9. The system is extremely flexible with respect to size of plant and deployment strategy. The system is equally well suited to designs all the way from the 100 MWe range to the above 1000 MWe range. Similarly, the IFR is well suited to a single plant or to a reactor park with a small number of plants, and even to a many reactor plant deployment strategy.

If proven, the above features collectively would resolve most potential difficulties and roadblocks for the LMR today.

There are several aspects still to be proven, but the IFR is a high confidence path. The key points to be demonstrated are in fuels, reprocessing, and safety. There is good reason to expect successful resolution of the remaining issues since the developmental areas have a firm scientific basis and the rest of the system has been proven at EBR-II.

At the request of the Department of Energy, The University of Chicago last summer established a Special Committee of experts of the highest international stature to conduct an independent technical peer review of the IFR concept. The Committee completed its initial review and issued its report in October 1984. The Committee concluded that:

- "The IFR concept offers many important benefits, and
- The scientific evidence on which the present concept is based, although limited, is sound.

It is strongly recommended that ANL move forward at a rapid pace to explore further the feasibility of the concept."

Argonne has been given approval by the Department of Energy to conduct a two-year IFR feasibility R&D program. The objective of the two-year program, termed Phase 1, is to establish the basic concept feasibility by the end of FY 1986. Technical feasibility is to be shown in the necessary three key technical areas; fuel performance, pyrometallurgical process development, and establishment of the basic safety characteristics. In addition, the potential of the concept is to be quantified for ultimate economics and inherent safety advantages in conjunction with the ongoing industrial innovative design projects of Rockwell International and General Electric.

The work scope and progress to date in the Phase 1 R&D program are summarized below for each of the three main technology areas.

A. Fuel Performance Demonstration

The basic physical properties of the IFR fuel and the fuel/cladding interactions over a range of conditions, compositions, and temperatures are to be established. This work is proceeding across-the-board at the present time. Out-of-reactor experiments to establish the compatibility of the IFR fuel with advanced cladding materials, to characterize the distribution of the alloying elements within the fuel, to measure the thermal and physical properties of the fuel, and to establish calculational methods of modeling the fuel behavior, are all underway.

A second objective is to expand the IFR U-Pu-Zr fuel irradiation data base to provide the technical bridge between this alloy and the extensive EBR-II data base already in hand on a related metal fuel. The initial task was to quickly establish the capability for IFR U-Pu-Zr fuel fabrication at ANL-West, then to fabricate prototypical fuel subassemblies for irradiation in EBR-II and FFTF.

The fuel fabrication capability, termed the Experimental Fuels Laboratory (EFL) is now fully operational. All three planned EBR-II lead test subassemblies have been fabricated. These lead assemblies are being loaded in EBR-II at the present time. The FFTF lead test planning is also progressing on schedule.

B. Pyrometallurgical Process Development

The concept uses a revolutionary new reprocessing technique that promises substantial advantages in cost, simplicity, and deployment flexibility. The objective of the task is to establish the chemical feasibility of the proposed processes for recycle of discharged core and blanket materials and for disposal of the fission product waste. The major process steps are electrorefining, which will be used for the core material, and halide slagging, which will be used for the blanket. The work is to establish that product yields will be adequate, fission product removal will be sufficient, container materials and process reagents can be specified and will perform as expected, and that the processes are adaptable to remote operations.

The first electrorefining experiments on a mixture of uranium and simulated fission products have already been successfully completed. Plutonium based electrorefining and halide slagging work will start momentarily, as the construction of the necessary glovebox facilities is nearing completion. Finally, demonstration of waste treatment for the resulting wastes, including metallic, chloride salt, and gaseous volatile waste is planned. At the end of this development, the process would be a reality, on very close to practical scale.

C. Demonstration of Safety Characteristics

The new metallic fuel promises sharply improved inherent safety characteristics due to some unusual properties of the fuel. Its high thermal conductivity results in very favorable reactivity feedback characteristics under loss-of-flow accident conditions so that the severity of such events is significantly reduced. Further, fission gases entrapped within the fuel alloy matrix itself may provide a self dispersive mechanism that plays an important role in early termination of transient overpower accidents. The overall objective of this task is to provide the experimental data to validate unique inherent safety features and fully characterize the totality of safety features associated with metal fuel through detailed analysis, calculation modeling, TREAT in-pile tests, and out-of-pile experiments.

TREAT test preparations are progressing on schedule and completion of the first three tests is expected by the end of April. Experiments already carried out with irradiated metallic fuel indicate that the sharply increased fission-gas driven axial expansion postulated to take place above operating temperatures does in fact take place and provides the postulated feedback.

Assuming successful completion of the Phase 1 feasibility demonstration, and the Department of Energy approval to proceed with Phase 2, the next step is to demonstrate the practicality of the entire Integral Fuel Cycle using the EBR-II complex and the refurbished HFEF/South facility. These facilities are already in place. As previously mentioned, the HFEF/South facility has been decontaminated and is ready for the new equipment. The total cost is expected to be very modest. The facility upgrade and modifications are estimated to cost $12.2 million and the equipment $3.0 million. The attached table shows the total IFR program projected costs for both Phase 1 and Phase 2 programs. As the IFR program rests upon the technical expertise that exists within the ANL base program and the necessary test facilities, the cost estimate shown in the table assume continued funding support of the ANL facilities and technology development at the FY 1985 level.

Innovative Design Industrial Support

The ANL technology program is also deeply involved in support of the development of the industrial innovative designs -- the General Electric PRISM project and the Rockwell International SAFR project. The Argonne National Laboratory involvement in these projects is of a rather unique kind within the national laboratory system and is simply due to the breadth of Argonne capability in nuclear systems technology. Argonne is both an active participant in the design development, and a source of feature development and testing for the new features of the designs.

Much of the starting design for the SAFR primary system resulted from a joint collaborative effort between Rockwell International and ANL in the previous years. The collaboration on SAFR is continuing, including ANL design support for the following areas: reference core design development for both oxide and metal fuel, reactor thermal-hydraulics analysis, plant transient analysis, safety analyses evaluating design basis accidents, risk assessments, and fuel cycle facility design including flowsheets, equipment lists, facility layout and cost estimates.

Support for the PRISM project, although less well-defined at the moment, is being arranged to be of similar magnitude and importance. Core design studies will develop a metal core optimized for the smaller size PRISM module. The metal core should provide additional advantages for smaller modules because of the reduced control requirement associated with the burnup swing and the flexibility associated with the on-site integral fuel cycle. Additionally, ANL will be responsible for the design support in the following areas: refueling and services system development, reactor structural support arrangement, reactor coolant flow path optimization, risk assessment support, inherent safety evaluations, integral fuel cycle facility design, etc.

In addition to the support for SAFR and PRISM projects, ANL is also providing support for CoMO LSPB-Pool design activity in the core design and inherent safety evaluations, and for the CoMO activity as a whole.

The Argonne design and development activities are essential to these concepts, and are possible because of the unique ANL capability across the spectrum of reactor technology. Later, as innovative design concepts and features start to firm up, ANL will provide the necessary development and testing capabilities for key feasibility features such as, for example, reactor vessel cooling system air-side testing and materials development, EM pump high temperature insulation development/testing, thermal hydraulics validation of new configurations, steam generator booster tube concepts, and other innovative features. Without technology development and analyses capabilities of these kinds, these concepts and any other new reactor designs will remain paper designs only.

The Status of the Argonne National Laboratory Reactor Development Program

The previous sections have described the content of the program, its goals, and its current status. In summary, the Argonne nuclear systems technology development capability, both in R&D activity and facilities, although squeezed by budgetary stringencies over the years to half the size it once was, remains active and whole. In fact, the opportunity to work on a new generation of reactors, and in particular, the IFR, has made the program a highly motivated one over the past year. Further, I believe that the work being done at Argonne is causing some desirable rethinking across the program as a whole, and is acting as a focal point for activities leading to a new generation of liquid metal cooled reactor concepts. The work on the IFR concept itself is proceeding very rapidly. The collaboration with the industrial firms on developing specific designs, including the IFR concept option, is also work that we see as challenging and worthwhile and that can lead to real advances in the reactor field. So at the moment, the picture is one of optimism and excitement.

The future, however, as embodied in the Department of Energy FY 1986 budget appears to be very different. The Argonne Reactor Development Program, including both the R&D portion and the facilities, totals about $70 million in operating funds annually. Of this, about $40 million is used to support the facilities at Argonne-West, $30 million for the R&D elements that are largely centered at Argonne-Illinois. Based on the information in the Laboratory tables accompanying the Department of Energy's FY 1986 budget, it appears that the total budget is to be cut from $70 million to $53 million. Further, it is our understanding that the preliminary allocation allots $44 million of this $53 million to facility operation, and cuts the R&D from $30 million to $9 million. Under these circumstances, the Technology Elements, the design, analysis and experiment development, quite simply the entire R&D capability, would disappear. The development of the IFR would stop entirely. The support for the industrial innovative designs would also terminate. The programs that the facilities are used for would also terminate. We can only assume that the operation of the facilities themselves, which are useful only in concert with the R&D, would be closed down within a short time and bring the entire program to a an end.

It is obvious that such a future must be viewed with extreme concern. In effect, the technology base in the U.S. for nuclear systems development will have been dismantled. Nuclear Systems Technology, went from $54.1 million nationally in FY 1984 to about $36.5 million nationally in FY 1985 and, although it is not possible to determine the precise amount devoted to this area in FY 1986 because of changes in budget categories, it would go to some small fraction of its current level. The implication seems obvious.

IFR Program Funding Requirements[a]
(in thousands of dollars)

	Phase 1 Feasibility Demonstration			Phase 2 Fuel Cycle Demonstration			
	FY 84	FY 85	FY 86	FY 87	FY 88	FY 89	Cumulative
Technology Development							
Operating Expenses	4,400	11,023	14,800	15,000	15,000	15,000	75,223
Capital Equipment	180	725	1,000	1,000	500	-	3,405
Fuel Cycle Facility							
Refurbishment							
Capital Equipment				-	2,000	1,000	3,000
Construction				3,200	5,000	4,000	12,200
Total							
Operating Expenses	4,400	11,023	14,800	15,000	15,000	15,000	75,223
Capital Equipment	180	725	1,000	1,000	2,500	1,000	6,405
Construction	-	-	-	3,200	5,000	4,000	12,200
							93,828

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[a] FY 84 and FY 85 numbers represent actual funding levels. Funding requirements for FY 86 and beyond are estimated proposals which have not been approved yet.

Mr. **Stallings**. Thank you, Dr. Till.

We're going to change our normal procedure. Mr. Fawell has to catch a plane this afternoon, and he would like to pose a couple of questions. So we will have you go ahead with those questions now.

Mr. **Fawell**. Well, thank you very much, Mr. Chairman. I apologize for being out of order here a bit, but I do, as indicated, have to get set to catch a plane.

Is it true, Dr. Till, that insofar as DOE is concerned, that there are no funds allocated for the IFR project in fiscal year 1986?

Dr. **Till**. There are no funds specifically allocated to the IFR project. Zero.

Mr. **Fawell**. Now, I have studied the budget a bit myself, and although these figures are still kind of swimming around in my mind, it appears that the total cut that Argonne is to take is $46.5 million, and they took $13 million from the present fiscal year. Is that right?

Dr. **Till**. That's the correct number labwide, Mr. Fawell.

Mr. **Fawell**. In terms of personnel—assuming that these are hopefully just tentative, very preliminary, never to come into fruition figures are correct—how much in personnel would be lost?

Dr. **Till**. Between 1,000 and 1,300.

Mr. **Fawell**. And of that figure, what portion would be what I would call science professionals?

Dr. **Till**. Approximately half.

Mr. **Fawell**. And that, in your opinion, would do what to Argonne as a viable institution?

Dr. **Till**. Mr. Fawell, that's one-third of the total personnel of the laboratory, and the reactor program, the breeder program, has traditionally been the source of support for large portions of Argonne National Laboratory, the shops capability, the electronics capability, the kinds of things you need for a world-class institution.

If this budget were to go through, I believe that Argonne as an institution as we've known it wouldn't exist.

Mr. **Fawell**. It's obvious it would have a ripple effect upon Argonne West.

Dr. **Till**. It would have a devastating effect on the Illinois Park and, as I indicated in my testimony, with the absence of R&D programs to go into the Idaho facilities, I can only assume that the Idaho facilities would follow shortly, yes.

Mr. **Fawell**. Now, the peer review committee, who constituted the committee?

Dr. **Till**. The membership were drawn by the University of Chicago from the most respected names in our field. They included people like Manson Benedict, the founder of the nuclear engineering school and chairman at MIT, the Nobel Laureate Hans Bethe, the head of reprocessing for many years at Du Pont. And I could go on. But they were men of the highest reputation and stature.

Mr. **Fawell**. Was the peer review committee also at least a partial response to a request for such a peer review study from DOE to Chicago?

Dr. **Till**. In fact, yes, Mr. Fawell. It was a request by DOE headquarters to have a searching peer review of the concept before the department felt it wise to go ahead in committing to the program.

Mr. **Fawell**. And I take it the peer review committee was rather unanimously of the view that this concept, which is certainly the newest concept, I gather, should go full force ahead?

Dr. **Till**. It was a very strong endorsement. They were asked basically to do two things: First, to assess the promise of the concept; and second, to assess the adequacy of the evidence for the—the adequacy of the scientific evidence—as a basis for the claims that were being made. And in both cases, the findings were very positive and the recommendation was to proceed rapidly with the development.

Mr. **Fawell**. Was that submitted then to DOE for their approval?

Dr. **Till**. Yes, indeed.

Mr. **Fawell**. And was it approved?

Dr. **Till**. The department has funded the IFR in fiscal 1985 at a level specifically of $10 million, which is sufficient, and we are proceeding, as I say, rapidly with the development. The problem is there is a cliff approaching us at the end of this fiscal year.

Mr. **Fawell**. Fine. Thank you very much.

And again I apologize, Mr. Chairman, for having to step out of order here. I thank you.

Mr. **Stallings**. I think that was very worthwhile.

Let's proceed, Dr. Wolfe, with you.

STATEMENT OF DR. BERTRAM WOLFE, GENERAL ELECTRIC CO.

Dr. **Wolfe**. Thank you, Mr. Stallings, and committee members.

General Electric is pleased to be selected as one of the two participants in the advanced Liquid Metal Converter Reactor Program. We believe that this is an opportunity for the United States to stay in the forefront of liquid metal reactor development at a cost to the United States far below that which is being spent in Europe and Japan, and represents one of the few viable ways for us to remain leaders in the LMR development program.

We believe that our present concept, our modular liquid metal reactor concept, has a high potential for satisfying the objectives I outlined at the beginning of this session; namely, we think that matching the module power level to a factory-producable size promises that we will have an infallible or very highly reliable shutdown heat removal system that not only assures safety but protection of the owners' investment.

This is again a passive self-protecting kind of arrangement. The modular size is set so that under all accident conditions that we can envision, the heat can be taken away through the vessel and sent to the atmosphere through natural convection. The size of the reactor is set on this basis. The size of the module is of the order of 100 megawatts electric. And of course, as I indicated before, that does not mean that the plant itself should be 100 megawatt electric; the plant can be 500, 1,000, or 2,000 megawatt electric as we put these modules together. In our present concept we would probably recommend putting these modules together in three at a time so that we would have 300 megawatts in parts, consisting each of three modules.

It appears that the reactor we've been designing can be made to shut itself down upon upset events before any major damage is experienced, and so the reactor under extreme accident conditions can be started up again.

The size is specifically set to facilitate factory fabrication, assembly, and shipment to the site from a factory and to allow for rapid installation. And perhaps, as I indicated before, most important for these new concepts, the nonlight water concept, the design, development, and the safety test of our modular approach we think promises to be in the hundreds of millions of dollars rather than in the many billions of dollars. And key to our approach is that once we do the modular test, we believe that we then have essentially the commercial reactor.

This is in contrast to the European approach or our own approach at Clinch River. Again I want to indicate we were part of it and supported it, and we were part of formulating that kind of design under different conditions in the United States. But in that type of approach, one builds a small 300-megawatt or 500-megawatt test plant and then, if it's successful, develops it to a 1,000-megawatt plant which, if successful, gives you an invitation to another $5 billion or more near-prototype plant, et cetera. And it's not clear in this country under present conditions whether that approach will converge. It is certainly, in our view, unlikely that one could get the financing for it.

Our major concern, or, I should say, the limiting item, in terms of timing for the LMR, the reason we believe it is later than the HTGR that we discussed before, is the need to establish a new fuel cycle, new in the sense that we think the present approach on reprocessing fabrication of plutonium throughout the world is too expensive and is not economic either for recycle in light water reactor or certainly in the breeder. We think that we need to develop a more economic type of fuel cycle which also addresses the key political issues—namely, the proliferation issue—and does it in a way that can be accepted, in a way that can be done economically and politically, can be politically accepted.

I was critical about the Government a few moments ago. I want to make it clear that I am talking about institutions and not people. We have the highest respect for the people in DOE and in NRC.

And in that respect, it gives me some pleasure to indicate that we do believe that the Department of Energy should be commended for following the Clinch River demise with an approach on this innovative design and allowing, I think, the United States to move forward after what could have been a disaster. We're pleased with their approach on this. We think that the plan, which is a 39-month design of plant that we're participating in, and Atomics International has the other contract—will result in design work that will indicate the feasibility of this approach, give us at least a realistic assessment of the technical and economic promise of the modular breeder approach and allow us to develop a follow-on plan that will lead to the licensing test which we think is essential to the work and to moving this to commercialization.

I do want to indicate that I think the advantage of the approach that DOE has taken in terms of providing a focus may be demonstrated by just the way we've been able to work with Chuck Till and his Argonne Laboratory, and John Nolan in HEDL, and also

Oak Ridge. And each of those in addressing this modular concept has made substantial contributions to the work. So we're very pleased with the help that we've been getting all along.

Mr. Stallings, I have talked quite a bit today, and if I leave you with a few minutes extra, I hope that I have given you the information, you and the committee, the information that you want.

Mr. STALLINGS. Thank you very much.

Mr. Meyers, would you please proceed?

STATEMENT OF G.W. MEYERS, VICE PRESIDENT, ATOMICS INTERNATIONAL, ROCKETDYNE DIVISION, ROCKWELL INTERNATIONAL CORP.

Mr. MEYERS. I am Wayne Meyers, the vice president of Atomics International, which is a business segment of the Rocketdyne Division of Rockwell International Corp. Rockwell's principal expertise in the field of advanced reactor systems is in the design and operation of liquid metal cooled reactors.

Our experience in this field includes the pioneering research, development, design, construction, and operation of eight liquid metal cooled reactors for terrestrial and space applications in the 1950's and 1960's; our major role in the U.S. liquid metal fast-breeder reactor program since its inception; and the design, construction, and operation for the past 18 years of the world's largest facility for testing liquid metal sodium components, the DOE's Energy Technology Engineering Center.

The Nation's past investment, which your subcommittee has supported, in liquid metal cooled reactors provides a heritage of technology which is applicable to many of the requirements currently foreseen for commercial, secure military, and space nuclear powerplants. LMR's are a natural choice for a wide range of potential applications where high performance, compact size, and enhanced safety are desired. Rockwell continues to believe that the LMFBR is the most promising and most practical energy source that can be commercially developed during the foreseeable future.

Furthermore, work we presently have underway convinces us that fast spectrum nonbreeder LMR's can be very attractive alternatives to light water reactors for central power station in the coming decades.

During the past year we have been successful in winning competitive awards for three different conceptual design efforts based on our proposed LMR concepts. These are conceptual plant designs for central station, secure military, and space nuclear power applications. The same basic technology and design principles are being employed in each of these plants.

The key requirement we establish for all of these designs is public safety and investment protection by means of a variety of intrinsic features which insure reactor safety. It is our firm belief that emphasis on safety is the key to convincing the American public that nuclear reactors are of beneficial use to the Nation.

Today I would like to cover more specifically Rockwell's approach to the innovative liquid metal reactor design effort and DOE's related advanced technology programs.

Rockwell's sodium advanced fast reactor, SAFR, innovative concept is supported by our major subcontractors, Bechtel National, Inc., and Combustion Engineering, Inc. An artist's schematic is included for your reference at the back of the testimony.

The plant assures both public safety and investment protection by means of a variety of passive safety features. The design incorporates highly reliable inherent capability for reactor shutdown under all circumstances and provides multiple reliable and self-actuated systems for assuring adequate core and spent-fuel cooling at all times.

The design also capitalizes on the favorable intrinsic properties of sodium: High boiling point, low vapor pressure, strong natural convection.

Additionally, the thermal reactivity response characteristics of the overall assembly result in self-regulated power reduction of the reactor to levels in equilibrium with natural convection heat removal, even under the extreme circumstances of loss of primary flow with failure to scram.

Overall, this means that natural inherent processes will ensure that the reactor is shut down and safely cooled even if the highly reliable engineered safety features fail to operate. The design depends essentially on gravity and thermal expansion, not rapid operator response to any emergency.

All of the radioactive primary sodium is contained within a stainless-steel vessel that has no penetrations. The vessel integrity is also enhanced by maintaining the walls at the reactor inlet temperature. The guard vessel surrounding the reactor vessel maintains a safe sodium level above the core in the case of a very unlikely event of a reactor vessel leak.

The guard vessel provides a containment boundary below the head access area, and this allows the reactor air cooling decay heat removal system to operate outside of containment.

Studies to date lead our industrial team to believe that a SAFR plant utilizing multiple-standard 330-megawatt electric power units has a very potential future for alleviating many of the concerns currently confronting the electric utility industry. The 330-megawatt size was chosen after a lengthy and detailed study of possible unit sizes ranging from 110 to 1,350 megawatts electric. The 330 choice provides an optimum balance between cost and quality advantages of shop fabrication, and economy of scale while limiting investment risk and allowing retention of diverse passive shutdown heat removal systems. Our evaluation showed the 330-megawatt size to have a significant cost advantage over smaller units studied.

Each unit is coupled to its own turbine generating unit which operates at conventional turbine steam conditions. A compact reactor building arrangement enhances safety and maintainability while minimizing construction scheduling costs.

The reactor vessel is embedded in the basemat, and seismic loading is limited by supporting the vessel and key components from the basemat. Hatches in the reinforced roof of the reactor containment building permit vertical handling of equipment for maintenance by a crane and minimize the building height.

Shop fabrication of the reactor assembly eliminates nuclear-grade ASME section III field fabrication and reduces the plant construction schedule. The heat transfer system incorporates some improved components such as the inducer pumps and booster tube hockeystick steam generators.

The reactor core can employ either oxide or metal fuel. Our study is addressing both onsite and centralized offsite reprocessing approaches, as well as a once-through enriched uranium stowaway approach in which the spent fuel is stored for eventual retrieval and reprocessing.

The use of an onsite fuel cycle facility to reprocess spent fuel and fabricate new core assemblies provides a highly desirable proliferation safe fuel cycle.

It is not expected that plutonium would be shipped offsite during the 6-year lifetime of the plant. We believe this could be an important contribution to public acceptance, but recognize the concerns utilities may have regarding onsite reprocessing and fuel fabrication.

We are very pleased with the way DOE has restructured the base technology programs in support of the innovative designs. As a result, we are receiving a considerable amount of additional assistance from the major participants in the DOE base program, in particular from Argonne National Laboratory and Oak Ridge National Laboratory, and I might add, also from HEDL.

The great value of sodium-cooled fast reactors is recognized by most industrial nations of the world, as evidenced by the strong development programs overseas. Sixteen liquid metal reactors and at least eight other sodium-cooled reactors have operated in six countries. Operation of these plants has proven to be comparatively simple, and the accumulative radiation exposure of plant operating personnel have been substantially below levels associated with lightwater reactors.

The exceptional inherent safety characteristics of LMFBR's have been well demonstrated in various reactor experiments. In one particular test, with the Rapsodie reactor in France, conditions of loss of flow without reactor scram were deliberately created and the self-regulating characteristics of the reactor safely reduced the power to a stable equilibrium level with passive cooling. No action by the operator was required.

The SAFR design concept is based on proven technology in a new configuration. However, additional testing of key components is required to demonstrate reliability and particularly earn utility confidence.

One component deserving special attention is the steam generator. Thorough testing at ETEC using a cogeneration arrangement to defray operating costs would certainly appear cost effective.

Several alternative paths to commercialization of the SAFR concept are currently under study by the Rockwell-Bechtel-CE team as part of our current 39-month program.

In summary, we believe that we're making good progress in our efforts to develop a liquid-metal-cooled fast-reactor concept with passive safety features, which is economical and sized to meet the future needs of most U.S. utilities. The concept appears to be competitive with alternate energy sources either with or without fuel cycle closure. The DOE LMR-based technology program is being directed to support this design, and we should be ready to start the next major step, design and construction of a prototype unit, near the end of this decade.

Successful completion of this project would provide the United States with a viable nuclear option which could be a backup to LWR's in the intermediate future and could keep alive the technology that will be required for the breeder reactors of the future.

I would like to thank you for the opportunity to testify. I hope my comments have been helpful, and I would be happy to answer any questions.

I would also like to thank your staff for setting up this meeting and coming to visit and spend some time with us.

[The prepared statement of Mr. Meyers follows:]

STATEMENT OF G. W. MEYERS*

BEFORE THE
U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION

FEBRUARY 21, 1985

*
Vice President, Atomics International
Rocketdyne Division
Rockwell International Corporation

TESTIMONY OF G. WAYNE MEYERS
HOUSE SCIENCE & TECHNOLOGY SUBCOMMITTEE HEARINGS ON ADVANCED REACTOR PROGRAM

I am Wayne Meyers, the Vice President of Atomics International which is a business segment of the Rocketdyne Division of Rockwell International Corporation.

Rockwell's principal expertise in the field of advanced reactor systems is in the design and operation of liquid-metal-cooled reactors. Our experience in this field includes the pioneering research, development, design, construction, and operation of eight liquid-metal-cooled reactors for terrestrial and space applications in the 50s and 60s; a major role in the U.S. Liquid Metal Fast Breeder Reactor Program since its inception; and the design, construction, and operation for the past 18 years of the world's largest facility for testing liquid metal components--the DOE's Energy Technology Engineering Center (ETEC). This DOE laboratory is known worldwide for its expertise in liquid metal technology and is the site of some of the world's finest and most versatile test facilities.

The nation's past investments, which your subcommittee has supported, in liquid-metal-cooled reactors provide a heritage of technology which is applicable to many of the requirements currently foreseen for commercial, secure military, and space nuclear power plants. It is from this perspective that I wish to address the subject of advanced reactor power systems.

Liquid-metal-cooled reactors (LMRs) are a natural choice for a wide range of potential applications where high performance, compact size, and enhanced safety are desired. Rockwell continues to believe that the LMFBR is the most promising, most practical energy source that can be commercially developed during the foreseeable future. Furthermore, work we presently have underway convinces us that fast spectrum, non-breeder LMRs can be very attractive alternatives to Light Water Reactors (LWRs) for central power stations in the coming decades.

During the past year, we have been successful in winning competitive awards for three different conceptual design efforts, based on our proposed LMR concepts. These conceptual plant designs are for central station, secure military, and space nuclear power applications. The same basic technology and design principals are being employed in each of these plant designs. One of the key requirements we established for all of these designs is public safety and investment protection by means of a variety of intrinsic features which naturally assure reactor safety. It is our firm belief that emphasis on safety is the key to convincing the American public that nuclear reactors are of beneficial use to the nation.

Today I would like to cover more specifically Rockwell's approach to the innovative liquid metal reactor design effort and DOE's related advanced technology programs. Rockwell's Sodium Advanced Fast Reactor (SAFR) innovative concept is supported by our major subcontractors--Bechtel National, Incorporated, and Combustion Engineering, Incorporated. An artist's schematic is included for your reference during the remainder of my testimony.

The SAFR plant assures both public safety and investment protection by means of a variety of intrinsic features which naturally assure reactor safety. The design (1) incorporates highly reliable and inherent capability for reactor shutdown under all circumstances and (2) provides multiple, reliable, and self-actuated systems for assuring adequate core and spent fuel cooling at all times. These features augment the large basic design margins, redundancies, and other natural convection cooling features in the design.

The design also capitalizes on the favorable intrinsic properties of sodium (e.g., high boiling point, low vapor pressure, strong natural convection). Additionally, the thermal-reactivity response characteristics of the overall assembly result in self-regulated power reduction of the reactor to levels in equilibrium with natural convection heat removal, even under the extreme circumstances of loss of primary flow with failure to scram. Overall, this means that natural, inherent processes will assure that the reactor is shut down and safely cooled even if the highly reliable engineered safety features fail to operate. The design depends on gravity and thermal expansion, not rapid operator response to any emergency.

All of the radioactive primary sodium coolant is contained within a stainless steel reactor vessel that has no penetrations. Vessel integrity is also enhanced by maintaining the walls at the reactor inlet temperature. The guard vessel surrounding the reactor vessel maintains a safe sodium level above the core in case the very unlikely event of a reactor vessel leak should occur. The guard vessel provides the containment boundary below the head access area. This allows the reactor air cooling decay heat removal system to operate outside of containment.

Studies to date lead our industrial team to believe that a SAFR plant utilizing multiple, standard, 330-MWe power units has very good future potential for alleviating many of the concerns currently confronting the electrical utility industry. The SAFR modules would be factory-fabricated and shipped by barge to the site as needed to closely match increases in customer electrical demand. We believe that with continued growth in the economy, there will be a need for significant additional capacity during the 1990s.

The 330-MWe module size was chosen after a lengthy and detailed study of possible unit sizes ranging from 110 MWe up to 1350 MWe. The 330-MWe choice provides an optimum balance between (1) cost and quality advantages of shop fabrication and (2) economy of scale, while limiting investment risks and allowing retention of diverse, self-actuated shutdown heat removal systems. Our evaluation showed the 330-MWe unit size to have significant cost advantages over smaller units studied. Cash flow analyses also show the 330-MWe units, with short construction schedule, represent a lower overall investment risk than do large integral power plants.

Each 330-MWe unit is coupled to its own turbine-generator unit, which operates at conventional fossil turbine steam conditions. The compact reactor building arrangement enhances safety and maintainability while minimizing construction schedule and costs. The reactor vessel is embedded in the basemat, and seismic loading is limited by supporting this vessel and key components from the basemat. Hatches in the reinforced concrete roof of the Reactor Containment Building permit vertical handling of equipment for maintenance by a crane and minimizes the building height. Shop fabrication of the reactor assembly eliminates nuclear-grade (ASME Section III) field fabrication and reduces the plant construction schedule. The heat transfer system incorporates improved components such as inducer pumps and "booster tube" hockeystick steam generators.

The reactor core can employ either oxide or metal fuel. Our study is addressing both on-site and centralized off-site reprocessing approaches, as well as a once-through enriched uranium stowaway approach in which the spent fuel is stored for eventual retrieval and reprocessing. The use of an on-site fuel cycle facility to reprocess spent fuel and fabricate new core assemblies provides a highly desirable proliferation-resistant fuel cycle. It is not expected that Pu would be shipped off-site during the lifetime of the plant. We believe this could be an important contribution to public acceptance but recognize the concerns utilities may have regarding on-site reprocessing and fuel fabrication.

The SAFR design rests on an extensive base of proven technology, but represents a new configuration which provides enhanced safety and low capital costs. We are very pleased with the way DOE has restructured the base technology programs in support of the innovative designs. As a result, we are receiving a considerable amount of additional assistance from the major participants in the DOE base program, in particular from Argonne National Laboratory and Oak Ridge National Laboratory. We feel that early deployment of LMRs is a logical intermediate step which will greatly facilitate the later transition to breeders. Also, LMRs provide a unique avenue to utilization of a major national asset, i.e., the extensive reserves of depleted uranium already mined and stored at various facilities in the country.

The great value of sodium-cooled fast reactors is recognized by most industrial nations of the world, as evidenced by the strong development programs overseas. Sixteen liquid metal fast reactors and at least eight other sodium-cooled reactors have operated in six countries. Operation of these plants has proven to be comparatively simple, and the cumulative radiation exposures of plant operating personnel have been very substantially below levels associated with light water reactors. The exceptional inherent safety characteristics of LMFBRs have been well demonstrated in various reactor experiments. In one particular test with the Rapsodie reactor in France, conditions of loss of flow without reactor scram were deliberately created and the self-regulating characteristics of the reactor safely reduced power to a stable equilibrium level with passive cooling. No action by the operator was required.

The SAFR design concept is based on proven technology, but additional testing of key components is required to demonstrate reliability and earn utility confidence. One component deserving special attention is the steam generator. Light water reactor steam generators have been the single greatest cause of forced plant outages and avoiding such problems in future liquid metal plants by thorough testing at ETEC using a cogeneration arrangement to defray operating costs would certainly appear cost effective.

Several alternate paths to commercialization of the SAFR concept are currently under study by the Rockwell-Bechtel-CE team, most of which include the following steps:

- Step 1 - Successful completion of the 39-month conceptual design and development program we are currently performing for the Department of Energy. An important output from this program will be a series of topical reports approved by the NRC that support the licensability of the SAFR concept. In DOE-sponsored discussions, the SAFR design, safety, and reliability characteristics are being reviewed with the Nuclear Regulatory Commission. NRC reactions to date have been very favorable, but several areas have emerged where additional detailed discussions are planned.

- Step 2 - Establishing an owner organization willing and able to invest in a SAFR prototype plant and performing a site-specific preliminary design and safety analysis that will be reviewed with the NRC. The important results of this step will include detailed cost and schedule estimates, an acceptable financing package, the submittal of a Preliminary Safety Analysis Report and an Environmental Report, and NRC approval of topical reports on remaining safety issues that confirms the licensability of the plant design.

- Step 3 - Obtain necessary financing and other approvals to proceed with a SAFR prototype plant. Depending on the ownership and management arrangement, this could include actions by the Federal Government. It is estimated that detailed engineering and fabrication of long-lead items could start in 1990. NRC reviews of the design and safety analyses during this period could result in a construction permit being issued by mid-1992, at which time site preparation and construction could commence. Construction and installation of the factory-manufactured reactor assemblies and other components is estimated to take around 26 months. Following a 13-month startup and test period, full-power, commercial operation could begin around 1995--approximately 10 years after initiating the proposed conceptual design and development effort.

- Step 4 - After the SAFR demonstration plant has been built, licensed, and operated successfully long enough to build users' confidence and reduce manufacturers' and constructors' risk, replicate plants could be offered on a commercial basis, probably in the late 1990s. Fortunately, this time period coincides with a projected critical shortage of generating capacity, so the market timing should be excellent.

In summary, we believe that we are making good progress in our efforts to develop a liquid metal-cooled, fast reactor concept with passive safety features which is economical, and sized to meet the future needs of most U.S. utilities. The concept appears to be competitive with alternate energy sources either with or without fuel cycle closure. The DOE's LMR base technology program is being directed to support this design, and we should be ready to start the next major step--design and construction of a prototype unit near the end of this decade.

Successful completion of this project would provide the U.S. with a viable nuclear option which would be a backup to LWRs in the intermediate future and could keep alive the technology that will be required for breeder reactors of the future.

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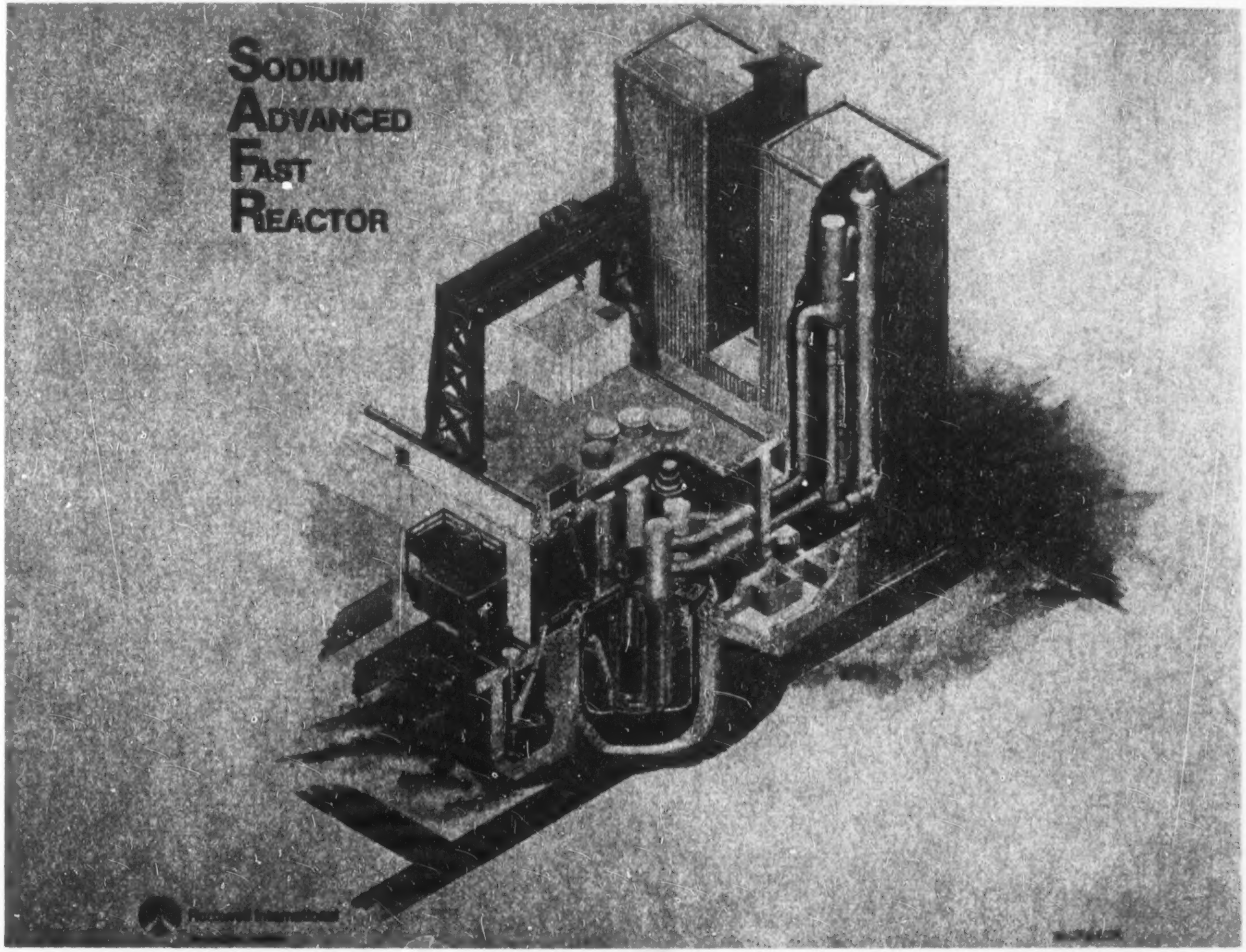
SODIUM
ADVANCED
FAST
REACTOR

G. W. MEYERS
VICE PRESIDENT
ATOMICS INTERNATIONAL
ROCKETDYNE DIVISION
ROCKWELL INTERNATIONAL

Mr. Meyers joined Atomics International in 1960 and is presently the Vice President of the Atomics International business segment, Rocketdyne Division, Rockwell International.

Over the past 24 years, Mr. Meyers has held management positions related to nuclear programs and facilities at AI, including the position of Vice President and General Manager of the AI Division when it was part of the Energy Systems Group. He previously held management positions associated with fuel and test facility programs, LMFBR programs, power systems, and space nuclear auxiliary power fuels. For a 2-year period, he was a director at ETEC responsible for sodium steam generator test facility upgrade to 70-MW capability. During his management positions, he had the responsibility for managing the operations of three hot laboratories.

From 1959 to 1960, Mr. Meyers was employed by the Hughes Tool Company on a master's fellowship program, prior to which he was employed by the Atomic Energy Division of Babcock & Wilcox.

Mr. Meyers received a B.S. degree in Mechanical Engineering from Iowa State College in 1957 and completed the Graduate School of Management Executive Program at the University of California at Los Angeles in 1979. He is a registered professional nuclear engineer in the State of California, a member of the American Nuclear Society, Atomic Industrial Forum, and holds numerous patents relating to nuclear fields.

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Mr. STALLINGS. Well, thank you very much all of you.

I would like to propose a couple of questions. First of all, Dr. Till, you project a very dismal picture. What is the DOE rationale for making such reductions? Have you received any explanation from the administration for this kind of program?

Mr. TILL. It's very hard for me to answer that question, Mr. Stallings. I guess I could just simply answer on the basis of the most obvious facts. The facilities in the program are being supported. I would guess something of the order of $150 million of the $200 million is going to facilities. I would guess that something like $15 or $20 million is going to design studies that would include the Rockwell, General Electric, and support for the EPRI COMO large-pool design. And if you subtract $170 from $200 million, you're not left with much R&D.

Mr. STALLINGS. Thank you.

Mr. Nolan, would you like to respond to that also? I understand that your firm was reduced very significantly also in the budget projections.

Mr. NOLAN. As to whether we had an explanation?

Mr. STALLINGS. Yes. Or what their thinking was or if they made any explanation to you for those reductions.

Mr. NOLAN. I can't say there is a specific explanation. I think if one looks at the size of the total budget and how one would live with a reduced-size budget, it was a distribution of the amount of reduction. And as Chuck Till said, there's no firm guidance to any of us as to what the fiscal year 1986 breakdown is. But essentially, our reduction would be about $20 million below the fiscal year 1985 level. The nature of the impact of that is what I described.

Mr. STALLINGS. Mr. Morrison, do you have any questions you would like to ask?

Mr. MORRISON. Yes. Thank you.

Sorry to miss your comments, Dr. Arnold. I have read them, and they're excellent.

I would like to pose, though, first a question to John Nolan. I think we've discussed fairly thoroughly, and we're aware of after yesterday's presentation and your comments today, that the FFTF program is significantly reduced in the department's proposal.

Can you attach a price tag for us on what it would take to continue to operate that part of the breeder research program without reducing the quality of the program? In other words, you've been significantly reduced over the last several years. Let's put a number on it. Can we do that?

Mr. NOLAN. I guess what I would put on that is that since we have responded to the reductions in the last number of years, and if you look at the realities of where we are, the most significant thing, I think, if we could maintain our fiscal year 1986 funding equal to our fiscal year 1985 funding and plateau out at a constant number that one could plan ahead on, that we could achieve the particular three kinds of things I mentioned today that are the essential elements of what I believe are programmed.

Mr. MORRISON. So you're supporting the freeze concept. That's rather popular around here these days. [Laughter.]

Mr. NOLAN. More or less.

Thank you.

Dr. Arnold, in reading through your testimony I find that you've listed several vital ingredients to the liquid metal reactor in being competitive with light water reactors and blending in to fit the timetable as you see it. I notice your item No. 2 is the long-life core design, which is, of course, the major emphasis at FFTF. Do you feel that's probably the most important ingredient of those that you've listed and that if that, in fact, is not achieved, that the liquid metal reactor will not fit into this scenario of America's energy future?

Dr. ARNOLD. I believe that is right, because if you contrast the liquid metal reactor with the light water reactor, we are currently running light water reactors without any fuel cycle closure. It's a once-through cycle. I think a liquid metal reactor requires either an extremely long-lived core or fuel cycle closure.

Now, the fuel cycle closure is the other option, but that's a great deal of expense there also. So I think the most cost-effective way to go to a feasible liquid metal reactor is, in fact, the long-lived core.

Mr. MORRISON. Thank you.

John, back to you. We hear a lot about international cooperation, and I know that it's going on, I know you have support at FFTF. But is this something we really can count on, and isn't it very slow in coming? It's not going to bail you out for 1986, for instance, in the budget proposal we have from the Department of Energy.

Mr. NOLAN. I don't believe that any foreign government is going to put any money into a U.S. program per se. One of the unique things we have in the Fastflux Test Facility is the special test assembly in which we can test miniaturized specimens of various materials and determine how their properties change or don't change or what happens to them under irradiation in the FFTF.

We do have this year about $2 million or so from Japan for those kinds of programs. So at those kinds of levels, I believe there is some possibility, but certainly I don't think any foreign government is going to put money in.

The thing on international collaboration, if I may, is, if you want, in view of a reduced program in this country, to be able to participate and take advantage of gaining data from what's being done in other countries, you need to have some bargaining chips that the other countries might be interested in obtaining. And what I offered in my testimony was the fact that I think that our long-lifetime mixed oxide core demonstration is something that puts us in world leadership and would be a bargaining chip and also our technology in fuel fabrication.

Mr. MORRISON. Thank you.

Thank you, Mr. Chairman.

Mr. STALLINGS. Mr. Young, would you care to ask questions?

Congressman YOUNG. Yes.

Mr. Nolan, Mr. Morrison had kind of started out on the line I wanted to pursue. As far as Hanford Laboratory is concerned, your statement indicated about 350 to 400 people would be lost with the proposed funding for fiscal 1986. What are the makeup of most of these people professionally, and what type of work do they do that would be such a serious setback to that facility?

Mr. NOLAN. You mentioned the word facility. Again, let me just say there are three major things I talked about. One is operating the facility successfully as a world-class facility as we have. Second, it's to complete the development of the fuel fabrication line; and third, the experiment for long-life fuel.

The nature of that would be about 50 percent of them would be R&D personnel. This would be a balance and decide over those programs where you would take the cut. But the other 50 percent would be people who are key—and they may range from operators to maintenance people to instrument technicians—to keeping an ability to run the FFTF plant as a first-class facility.

Congressman YOUNG. So once they're gone, they'll be hard to replace. I would assume they'd be.

Mr. NOLAN. Yes, sir.

Congressman YOUNG. They would be looking.

Mr. NOLAN. You don't replace those kinds of people easily.

Congressman YOUNG. It would be very hard.

Another question. You had mentioned about the bargaining chip. Would you want to expand on the core demonstration experiment, which is one of your major activities, and how it puts us well into the year 1990 if the program would continue?

Mr. NOLAN. Yes. I believe that if you look worldwide at what's been achieved, that with our first core system we're achieving in terms of, let's say, one year of core life and demonstrating that, we're at about the state of where the rest of the world is. If you're able to design a fuel system, a core internal system, if I may, where you could put it in and leave it there for 3 years, I think you've demonstrated a number of ways the improved economics of a liquid metal reactor, both from the fact that your capacity, your ability.

The number of days per year you could operate the plant continuously at full power would increase because you don't have to refuel and your cost of fuel would decrease because you make fewer assemblies. And that's the other part to work on is the fuel fabrication.

Congressman YOUNG. Thank you.

I have just one question, Mr. Meyers. You mentioned that the key to the future success of nuclear energy lies in convincing the American public that nuclear reactors are safe. And how can this be done in the current general perception that is out there right now, which worries all of us?

Mr. MEYERS. It's a super challenge, yes, but we've got to do something to explain to the people in terms that they'd understand that the reactor is safe. All right. I think people understand gravity. They may not understand thermal expansion. But we've got to get them convinced. Once you've got some public acceptance, then you've got PUC acceptance. If you've got PUC acceptance, then you can get financing. Then you can get a utility to buy it.

And so I think we've really got to work on the public. You're never going to convince 100 percent, but we've got to get a larger percentage than we've got now, and I think we've got to do it with something new and different, and learn from what's been done before.

Congressman YOUNG. I know that's been one of our problems, I think, in Missouri with the reactor at Calloway County, the question that hit right in the middle of Three Mile Island. And so you can imagine the problems that existed when that facility was being built, the activity at that particular facility was, you know, I am sure was part of the national headlines because of the construction that was going on at that time.

So, you know, it's been very costly to us in Missouri to finally have the facility completed, but there was always that question of the safety of the facility in Missouri.

Mr. MEYERS. Well, obviously, part of public acceptance is that it also has to be cost effective. In other words, that's the other little carrot that has to happen. You've got to have something that's cost effective, too.

Congressman YOUNG. Thank you.

Thank you very much, Mr. Chairman.

Mr. STALLINGS. Dr. Till, did you want to comment?

Dr. TILL. Yes, I did. I was reminded, in fact, by the questioning on the international agreements. It's an exception to what I had just made a blanket statement about the support of the facilities. In fact, in the language in the budget, the zero-power plutonium reactor in Idaho is to be shut down.

Now, that is the only critical facility left in the Nation to develop, to mock up any kind of a really new concept, you've got to have a critical facility. If you do away with that, you do away with the national capability to do that, you do away with the IFR, for example. It's got to have its critical experiments to prove the neutronics.

Now, the Japanese are willing to spend $1.5 million over the next 2 years on a Joint Critical Experiment Program on ZPPR. That covers—I am guessing—something on the order of 30 percent of the total cost. But it's real money. And for these reasons, again, I question severely the direction taken in the budget specifically with regard to our ZPPR in Idaho.

Mr. STALLINGS. Thank you.

Dr. Wolfe and Mr. Meyers, let me pose a question to each of you. In the fiscal year 1985 the Department allocated $14 million for innovative design activities, which I presume was distributed to each of you. Do you foresee any impact of the suggested fiscal year 1986 budget reductions on the continuation of your activities in developing innovative LMR designs?

Dr. WOLFE. We've just signed a contract with DOE on the 39-month program that I mentioned. And to my knowledge, at the present time we have not been informed of a cut.

Bob, is that correct?

So I will indicate that we have suffered with our colleagues here. Our advanced group has gone down over the past 3 years from some 800 people to about 300 people. We're just barely at what I think is a critical area here. So I don't want to indicate by my saying I haven't heard anything, that we're happy about things. But at least to date, DOE has indicated that they plan to go ahead in this critical design work on the prism reactor.

Mr. MEYERS. The DOE budget for the $14 million I don't think was totally distributed to GE and AI. If it was, I want to negotiate some of GE's share. [Laughter.]

OK, that's point No 1. No 2, that is a no-fee cost-share contract. So it's not a money-maker contract. So we really are committed, both GE and us, to do the program.

We've had discussions with DOE about a 10-percent reduction in 1986 that could happen in the funding level. Specifically, it's about four and a half people. We've evaluated where we'd take it out and what we'd do, and we'd handle it. It impacts on some of the base programs for further reduction.

We also are skinny. We have come down a long way from where we were a few years ago in manpower.

But our people are super-enthusiastic. We have got people that are really hustling. You're going to hear about the SP–100 and our activities in that program. And I can't talk about the secure military. But I am really enthusiastic about what's happening in our organization. I know that because the parking lots are full on Saturdays and Sundays and I am not paying overtime. OK.

Mr. STALLINGS. All right.

Mr. MEYERS. That's when you know you've got your people are really interested in programs. Thank you.

Mr. STALLINGS. Well, thank you very much, gentlemen. We appreciate your participation in this panel. We would ask you to respond to some written questions at a later date that we would like to include in this record. And we feel your testimony has been very helpful in helping us do our job. In fact, you make it much easier. We would like to thank you again.

Mr. Culler, will you come up to the table?

Our next witness will be Mr. Floyd Culler of Electric Power Research Institute.

STATEMENT OF FLOYD L. CULLER, PRESIDENT, ELECTRIC POWER RESEARCH INSTITUTE, ACCOMPANIED BY CLARK GIBBS, JOINT DEPARTMENT OF ENERGY-EPRI PROGRAM OFFICE

Mr. CULLER. Mr. Chairman, first of all, I would like to introduce you to Mr. Clark Gibbs, who is in charge of the joint Department of Energy-EPRI Program office on breeders in Naporville, IL. Dr. Clark Gibbs.

Second, I would like to make a matter of record the written testimony which I have submitted.

The Electric Power Research Institute functions somewhat in the role of the Department of Energy in trying to have an overview in long term of what a breeder program might be. And as I listened today to the LMFR discussions, there were several things that I think are important to mention in overall context of what you have been hearing.

First off, each of the people who has testified are discussing areas of great importance and high enthusiasm for new ideas in breeders. However, the rest of the world is operating rather successful liquid metal reactors. It is reasonably evident that for some time that the United States may not build a demonstration reactor of any kind and that our principal focus in learning about how liquid metal reactors will very strongly depend upon those international agreements that allow us to participate hands-on in activities in Japan, in France, possibly in Germany. The liquid metal program is of most importance in Japan, and they are most likely to be the ones who build the next and most successful reactor.

Three years ago the Department of Energy asked the Electric Power Research Institute to begin to develop with them a long-term overall pattern in which nuclear breeders and then liquid metal reactors might be considered. And I want to set this context, comment briefly on what the International Program now contains, and where some of our opportunities lie.

First, I think what you saw today and the concern about the budget and such is an effective action and a part of budget-cutting that will dismantle the Liquid Metal Fast Reactor Program in the United States. And it grieves me after 30 years in this to watch each of us sit here and plead again for the individual pieces of a program when the whole is being dismantled in such a way that the individual pieces may also collapse.

The actions taken in the past are not necessarily generated within the Department of Energy but it's part of a budget-cutting exercise. The overall long-term program basically for the period now must consider not only those reactors for which there is great enthusiasm as new ideas, but those also that are well developed and running successfully overseas.

As a consequence, recognizing that the liquid metal reactor is inherently safe, it is possible to design into them at any scale a system of decay heat removal that will make the reactor safe. In the long run then, it does seem to us that we have time to carry out a program in three phases, one, to explore again how to cut costs and improve the inherent safety of nuclear reactors, taking what we already know from the large reactors and reviewing, as you heard today, new reactor concepts.

It is reasonably apparent that even in the United States four good ideas would not be built and that at some point in the future a selection for a U.S. reactor prototype, preferably a world-class reactor, will have to emerge from evaluation.

As a consequence, the overall program that has been worked out is to evaluate how to cut costs of the very large reactors. The Department of Energy has spent in the last 3 years some $70 million to $80 million in the loop design, which has been evaluated at COMO, to reduce its capital cost and to improve its safety characteristics. And we have agreements to proceed with NRC on safety approval.

We are now evaluating, in conjunction with the Japanese, the pool-type designs based upon concepts that were developed in the United States, hopefully with input from Japan on similar activity.

The second phase of the long-term program basically will be—what we suggest is—the selection of a reactor on which all of the U.S. community can concentrate, rather than five or six concepts proceeding, and that this has to occur sometime in the 1990's. At that point, hopefully in conjunction with another country or two, a liquid metal reactor of world class might be built in which there would be international cooperation.

The liquid metal reactor would eventually, in a mature sense, emerge as a breeder in the period in post-2010, and many of the concepts which you have heard now lead into the idea of developing an international world-class reactor.

Now, in the immediate future, the program, as conceived overall in addition to the four or five concepts about which there is legitimate and evident enthusiasm, has other elements. The first is the necessary evaluation of the large reactors because the problem in fast reactors is not necessarily their workability or their operability or their safety, but their cost. And in order to estimate costs accurately, it's necessary to spend hundreds of millions of dollars in detailed design and to have enough detailed information to begin to discuss the details of safety approval.

Since both the loop design is well established over the last 15 years, it is the lead case for cost cutting. And that operation is about 50 percent complete. The pool class is now starting, and its evaluation will continue.

The second immediate phase is the activities which you heard described today, the evaluation of promising new, important ideas about what new reactor types maybe can be introduced in this period of evaluation. As they proceed, their technical problems, their evaluations and such must be cross-compared. The technical problems preferably should be assigned to a base program of development.

The third element then—the large cost-cutting exercise with safety approvals, the evaluation of promising new concepts—the third element is to maintain a very strong base program. What has happened is that in cutting the overall Fast Reactor and Nuclear Program in half, you're seeing the total dismantlement of each of the three elements. If, however, we do not maintain the base program in experimental work at an adequate level, I think, and the personnel and such in the laboratories, we will find a gradual erosion of effort.

The importance of international cooperation to the United States is not to get money from overseas—because that will not come—but to be able to have a strong enough program that will gain us entry into their data, because we will learn only from building in the long run, and not study and some experimental work. Since it is reasonably apparent that the United States will not make a major commitment to liquid metal reactors for 15 to 20 years, one of our objectives must be, clearly, to maintain a sufficient program with sufficient interest for foreign groups to allow us to participate in their programs.

In discussing now, I would make several other comments. We have negotiated formal agreements with the Japanese to participate in COMO in the evaluation. They are at the present time looking at cost-cutting on the large reactors because that's the direction they're going. So, too, are the French in Super Phoenix. We continue to discuss arrangements with the French and Germans that will allow us to get some of their current technology.

In our most recent talks, however, the question is, What's in it for us? What is it that we obtain? I have one suggestion as a possibility for a trading chip. The United States is as advanced, or more advanced, in the refabrication of fuel for breeders at Hanford in the line that you heard Mr. Nolan discuss.

In addition to that, that same facility has empty cells, small in scale but nonetheless totally adequate for a truly advanced reprocessing which could be done on Hanford fuel on the FFTF fuel in an integrated way at a small scale, by installing the BRET facility, which would give us, I think, a leg up in advanced reprocessing competence, recycle competence, with recycle of fuel to the FFTF that would be a significant trading-chip stand.

I therefore suggest not only the fabrication line but the reprocessing line, the BRET facility, as an important element in this long-range program.

Now I will finish very quickly in summary. It is important to realize, I think, what you heard today, basically the elements of an enthusiastic new program. But the world continues to move in breeders. The Russians are looking at breeders of 1,600- and 1,800-megawatt size. The British program, the French program, particularly the Japanese program, are moving at some pace. It is necessary in considering what individual reactor studies and programs are to be authorized to keep clearly in mind what the total long-range program must be.

And most certainly, in the long range, our participation in the joint development of world-class reactors, recognizing that there will not be a competitive market for breeders for 30 years or more, the joint development in a long-term sense is an important planning function now.

I am quite distressed at what's happening. We're witnessing in the present the dismantling of the Liquid Metal Program in the United States. It is not DOE's doing. It is an overall action that is partially supported within the Congress. This committee and the Senate committee are probably the two last places in which a comprehensive national program can be fit together.

Now, the Electric Power Research Institute and the Department of Energy have worked for 5 years in this development of overall cooperation, of going slowly to a single master plan. And we were asked to negotiate the agreements which we have with Japan and Great Britain and others that are in place, in part.

The program, if it is diminished much more than now, will fall apart not only domestically and each individual participant will scramble for his share, but we will also lose the necessary base for continuing our fragile international agreements.

Thank you very much.

[The prepared statement of Mr. Culler follows:]

EPRI
Electric Power
Research Institute

February 20, 1985

Ms. Debbie Johnson
U.S. House of Representatives
Subcommittee on Energy Research
 and Production
B-374 Rayburn House Office Building
Washington, D.C. 20515

Dear Ms. Johnson:

Enclosed is a copy of one of the two statements by EPRI President Floyd Culler for the hearing scheduled for 1:30 p.m. on February 21, 1985.

This copy is a corrected copy and is the version to be entered into the record. The only change is the addition of a reference on page 8.

Sincerely,

Mary W. Panke

Mary W. Panke
Communications Specialist

MWP:mdh

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STATEMENT TO
SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION
OF THE
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
TESTIMONY ON
LIGHT WATER REACTOR TECHNOLOGY

Floyd L. Culler
President
Electric Power Research Institute
February 21, 1985

Good afternoon. I am Floyd Culler, President of the Electric Power Research Institute. EPRI performs research, development and demonstration for the private and public electric utilities of the United States, including the federal utilities, TVA and Bonneville. Work sponsored by the utilities in R&D for nuclear power is centered in EPRI, although there are special independent, but coordinated, activities such as the Institute for Nuclear Power Operations, the ad hoc IDCOR activity on reactor safety and efforts sponsored through individual reactor manufacturers and architect engineers. EPRI and DOE coordinate and cooperate in R&D where appropriate.

Prior to moving to EPRI, I worked in nuclear energy development at Oak Ridge National Laboratory for 35 years, covering in a technical sense most aspects of nuclear energy and through all levels of responsibility. During the past 18 months, I have chaired the Light-Water Reactor R&D Panel of the Energy Research Advisory Board of the Department of Energy, which presented recommendations in 1983 on LWR Safety Research and Development (DOE/S-0024) and which is just completing its report on LWR R&D to improve performance, costs, reliability and operability. (In draft).(1)

My testimony will be directed to the development of advanced light water reactors only, with nothing on fuel cycle, waste disposal, regulatory practice and other subjects of importance. But it is necessary that we understand the current position of the utilities in the United States with respect to nuclear power. Thus, we can consider what directions the advanced development of the light water reactor should take to profit from the domestic and worldwide experience with this reactor type over the past 35 years.

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(1) Report on LWR R&D, Draft, January 1985, Energy Research Advisory Board, LWR Panel.

U.S. utilities stopped ordering generating facilities of all types for a few years because plants ordered earlier, under an environment far different than today's, are sufficient to meet capacity demands for a few years yet; perhaps until about 1990 or a bit earlier. The utilities, under today's conditions, now face strong economic, financial and regulatory disincentives to undertake new construction.

Recent projections by DOE (in support of NEPP)(2) indicate the need for significant additional electrical generating capacity by the year 2010; perhaps an increase of about 50%. Electricity generation will account for 45% to 50% of the primary energy consumed in the U.S. by about 2000 A.D. With a growth rate that is modest by historical standards, additional generating capacity will be needed by the mid-90's. If these capacity needs are to be met with conventional generating units that take 6 to 8 years or longer to build, many utilities will need to resume construction during this decade.

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(2) Energy Projections to the Year 2010, October 1983, U.S. Department of Energy, Office of Policy, Planning and Analysis.

New capacity will be needed to (1) support economic growth, (2) to provide for aging and retirement of plants, and (3) perhaps to reduce dependence on imported and uneconomic oil and, at some time in the future, gas. The existing U.S. demonstrated electrical generating capacity in 1983 was 596 gigawatts.(3) Peak demand of 448 Gw was recorded in July 1983, leaving a capacity margin of 25% (national averages). It may appear, and it's quite widely erroneously assumed, that this capacity margin could serve additional demand; however, 15% of that capacity is unavailable, leaving an operating margin of 10% (national averages). Like all other major equipment and machinery, electric generating equipment requires periodic maintenance and is subject to unanticipated service interruptions and equipment failures. Thus, during 1983, and at an almost constant level for the previous ten years, some plants were out of service and unavailable for these reasons. The remaining operating margin was available to serve demand, but was not needed during the 1983 peak period.

Although the operating margin was not used to generate electricity, it does have important functions. First, the operating margin provides a margin of safety for daily operations. Major equipment failures or sudden demand increases cannot be accurately predicted. To respond to these events and to prevent service interruptions, part of the operating margin must be held in reserve as instantly available capacity. Second, the operating margin gives utilities flexibility to employ their most economical plants to serve customers' demand and thereby to reduce fuel and operating costs. Without an operating margin, this cost savings is lost, because all available capacity would have to be employed.

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(3) Generating Capacity in U.S. Electric Utilities-An Update, (EA-3913-SR) Strategic Decisions Group, Electric Power Research Institute, December 1984.

As noted earlier, new capacity will be needed and many utilities have tentative plans for new additions. Of this tentatively planned capacity, a significant portion is at risk. You are familiar with the problems of nuclear. The troubled nuclear plants represent about 27 gigawatts or 21% of the planned capacity. Nineteen percent of the additional capacity is representated by coal not yet under construction and considered at risk because of current adverse financial conditions.

Thus, even in the short term, the question of servicing the demand for power with the most economical supply is in question. The importance of nuclear plants under construction is evident and is the basis for one category of near-term R&D on LWR's, i.e., that which can assist in the completion of nuclear plants under construction, most of which is clearly the responsibility of the private sector.

Is the nuclear option faulted?

I should note, as part of the background on nuclear power, that there is a large, viable, successful and active nuclear industry in the U.S. In 1983, operating reactors produced power cheaper or equal to other sources. (In 1983, on the average in the U.S., nuclear power cost about 3.5 cents per kwh, vs. coal at 3.5 and oil at 6.4 cents per kwh. There are significant variations region to region in costs.) In 1984, nuclear power represented about 12% of U.S. generating capacity and accounted for about 13.4% of the electricity produced in the U.S. Nuclear power--under development in the U.S. for the past 35 years--has established an impressive record in electricity supply. Last year, 87 licensed plants produced 325 billion Kwh of electric power, equivalent to the entire electrical power generation in the U.S. at the end of World War II. An additional 40 plants under construction will bring the nuclear contribution to over 20% of the nation's total. The world-wide contribution of nuclear power to electicity supply has been even more impressive. Two-hundred seven nuclear power plants are in operation outside the U.S., which produced approximately 600 billion Kwh last year, plus an additional 163 plants are under construction overseas.

But the uncertainty which now surrounds nuclear power, the severe institutional problems in certain utilities and units and regulatory problems which now exist, make it unlikely that utilities will order new reactors until there are changes in the regulatory and institutional setting which will allow utilities to operate at lower risk. An EEI committee has reported that, under present regulatory and institutional arrangements, no American electric utility would consider ordering a new nuclear power plant.(4) The costs and risks for nuclear development in the U.S. have become unacceptably high. Yet, as voiced in this same report, based on past experience in the U.S., on current foreign experience and on economic analyses, nuclear power could again be an economical means of meeting future demands for electricity, safely and reliably, and an option that utilities could rationally consider.

In spite of these current overriding institutional problems, the utilities make a strong case for removing those disincentives which have led U.S. utilities to abandon commissioning new nuclear plants. The units are not faulted, as much as the management and institutional structures. For example, recent research regarding the public risk from nuclear power plants shows that the current generation of LWR's are even safer than previously calculated. The implication of this research is that existing federal regulations--particularly those for emergency planning--are based on exaggerated scenarios of what would occur in the event of a nuclear reactor accident.

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(4) The Report of the Edison Electric Institute Task Force on Nuclear Power, February 1985, Edison Electric Institute.

The program goals of EPRI R&D for all forms of energy are to provide utilities with:

(1) technology for capital conservation and operation economy by increasing availability and lifetime of present plants (load management, conservation, co-generation, use of renewables).

(2) improved technology and flexibility to meet additional capacity requirements through use of coal, uranium and alternates in the 1990's.

(3) advanced technology, largely developed through the DOE program, to realize the full potential of nuclear power: through the liquid metal breeder to assure abundant fuel supply and through the HTGR to achieve capability to service co-generation and process heat energy demands.

The current programs at EPRI are heavily weighted toward the development of technology for capital conservation and operating economy. These programs include work on: (1) component and system reliability improvement, (2) in-service inspection and preventive maintenance development, (3) advancement in decomination processes, repair techniques, and occupational radiation exposure reduction, (4) source term and severe accident prevention, (5) plant life extension, and (6) extended fuel burnup. Many of these programs, which comprise over 90% of the EPRI Nuclear Division funding have been and are being performed through cooperative efforts with the Department of Energy and the NRC.(5) We hope that these cooperative efforts will continue and be expanded, particularly for source term research.

However, to realize the full potential of nuclear power, it is necessary to rationalize the design and operation of LWR's, the only reactor types that can be deployed with confidence and without massive demonstration. There is time now to consolidate and improve the performance of light water reactors, to thoughtfully rationalize their excellent record with the vast number of new regulatory requirements, to standardize, to reduce their cost, and to increase their availability and longevity. The private sector is supporting these activities, and a new industry-wide cooperative effort is being started by the Electric Power Research Institute.

In the private sector, the U.S. reactor vendors are continuing to develop improved versions of their current BWR and PWR Nuclear Steam Supply Systems (NSSS). In addition, some are working jointly with their overseas licensees to further refine and improve their individual designs. Each of the vendors recognizes the need for refinement of their individual designs to reduce the construction schedule and improved operational aspects of their systems. As such, they are reducing plant complexity, improving constructability and overall plant operability, and reducing capital cost.

(5)For a description of NRC/EPRI interactions, see EPRI JOURNAL, Washington Report: NRC Research Supports Nuclear Safety Goals, January/February 1984.

In parallel with the vendors activities in this area, the EPRI progam addresses Advanced LWR's from the standpoint of utility requirements. Under this program, EPRI will develop a set of requirement documents based on utility operational experience of present plants that will enhance the desirable and modify, mitigate, or eliminate the undesirable features. The program will identify plant simplification measures, increase margins to enhance safety and reduce investment risk, improve operability, and increase system and component reliability. High tech application of computer/solid state/telecommunications to all aspects of control will be a major part of the program. It is expected that standardization and simplification will reduce costs and shorten construction schedules. The program will also examine and evaluate reducing the size of future LWR's in the 500 MWe range. But these efforts will be primarily for design studies and will need DOE assistance, both for the studies and for experimental effort. Some DOE funding is vitally needed to support the national interest in this technology.

To assure that the results of the program reflect the needs of utilities and are consistent with the latest available technology, the program entails cooperative efforts by electric utilities, EPRI, reactor vendors, architect/engineers and the NRC. NRC participation is an integral part of the program. An NRC/Industry program for categorizing licensing issues for new orders has been ongoing for two years now, and as the need for

NRC review of requirements documents begins, their participation will have to increase. At a recent presentation of this program to the NRC Commissioners (February 7, 1985), the Commissioners commended the program and endorsed the need for NRC staff support.

This program encompasses all elements of the private sector nuclear industry in the effort to reach a set of broad and ambitious goals. With only those resources available from the private sector, progress toward those goals would be relatively limited. We note with enthusiasm the intent of the DOE to participate in this program. We believe that such participation will significantly enhance the program and will permit much earlier reopening of the nuclear option.

In summary, in order for the Industry Advanced LWR Program to be successful, both the technical issues, which are treated in this program, and the institutional issues, which are not being addressed here, need to be recognized and effectively handled. It is hoped then that toward the end of this decade, the confluence of utility requirements, vendor designs, and NRC approvals of both will provide utility management the technical confidence to authorize new nuclear plants.

The Industry Advanced LWR is predicated on the basis that the technology builds on decades of experience and that no demonstration projects are needed. There are other LWR concepts under consideration with the promise of greater economic safety and environmental characteristics but with goals which require intenstive R&D, "proof-of-principle" testing, and demonstration projects. While primary emphasis in these advanced concepts is on increased passive safety characteristics and small unit power size, the utilities need to know if these concepts are capable of achieving competitive capital costs and low operating costs with high reliability. These LWR concepts are not likely to be available for deployment until after the turn of the century when other advanced reactors (LWR, HTGR, modular LMR or HTGR, LMFBR, etc.) might also be available. The DOE Civilian Reactor Development Program should be broad enough in scope to support evaluation of these options.

In closing, I want to comment on the proposed DOE FY 1986 budget request for the Civilian Reactor Development Program. I believe the Department has done a commendable job in restructuring their programs since cancellation of the Clinch River Project, and in view of the severe budget constraints. I believe that their new initiatives in the "Improved LWR Development and Advanced Light Water Reactor (LWR)" areas are particularly important.

Mr. **Stallings**. Thank you. I appreciate those comments.

Have you had a chance to discuss many of your ideas and proposals with the Department of Energy?

Mr. **Culler**. We discuss them weekly, and our activities are very closely coordinated. The overall program plans and the spreadsheets that you will see are partially originated—we have a continuing exchange agreement, coordination agreement with DOE, that has been in effect for 10 years. Since EPRI's broad interest for the utilities somewhat corresponds with the broad interest of DOE, we do plan together and we attempt to make sense together.

There is a document in preparation which we will present as the national utility plan that has been jointly effected, in part, with our consultations with DOE. DOE has the immediate budgeting problem.

There is one other comment that I did not make. It is not likely that the electric utilities in any way will be able to participate significantly in these advanced programs beyond the $5 or $6 million a year or more that EPRI will be able to put in, for some period of time.

Mr. **Stallings**. Have you had much interest on the part of these other countries you've been dealing with, particularly Japan, on going along with the funding of some of these programs? Are they interested in that?

Mr. **Culler**. I think that to count on any significant funding from any foreign country would be a false hope. What they are looking for is participation in kind and where there are little experiments and such that are to their advantage in our facilities, they most certainly will do so. But they would not, for instance, undertake the expense of sustaining the FFTF.

Similarly, they expect us to invest in some of their facilities, and we do that to some extent. We have a big international earthquake program in which we spend significant money in Japan and Taiwan, and we do have formal agreements in which they are assigning people to COMO, to various contractors at GE and Westinghouse and others, that also work with EPRI.

Mr. **Stallings**. But they will want to share in a lot of the——

Mr. **Culler**. They will share in kind, but I doubt that there will be much money. In the long run it's conceivable, and those old hands who talk about an international program now, since 8 years ago, in trying to formulate a world program can envision the possibility of breaking down enough barriers so that the first reactor might be built in Japan in which we would participate in kind and then the second maybe in Britain or France, and the third. But they would be done in sequence so that we would all learn in a cooperative pool.

This is falling apart a little bit, but nonetheless, the interest still remains. And we will continue to pursue that as a possibility in our almost weekly and monthly conversations with the overseas partners.

Mr. **Stallings**. Do we share the results of these tests with them on an equal basis?

Mr. **Culler**. Almost everything that the Department of Energy and EPRI does in nuclear power is made available to everyone. There are restrictions of flow in the other direction, however. Both

Britain and France, and Japan to a limited extent, consider that there is a commerical viability to these programs. It really is not so. There will not be an international competitive market for 30 years, and France will not sell the United States a reactor and sell Japan a reactor. Japan will build Japan's reactor and Britain will build Britain's reactor with participation. And I think the United States will build the U.S. reactor, but we may get participation in kind.

The program that I hope you all will consider is one that has a time horizon that goes beyond 2010, the first phase of which you were discussing today, the evaluation reestablishment period. It cannot be on the small reactor enthusiastic new concepts alone. It must include, as part of the international cooperation the consideration and evaluation of costs and additional safety features to the large systems as well, because in all probability those are the only ones that will meet the economic test.

Mr. STALLINGS. Well, thank you very much, Mr. Culler. We would also like to submit to you some written questions at a later date. Thank you.

Mr. STALLINGS. Could we have the next panel, please. Dr. Ambrus and Dr. Vincent Truscello.

Dr. Ambrus, would you proceed?

STATEMENT OF DR. JUDITH H. AMBRUS, EXECUTIVE SECRETARY, CIVIL MISSIONS ADVISORY GROUP

Dr. AMBRUS. Mr. Chairman, I am Judith Ambrus. I am the executive secretary of NASA's Civil Missions Advisory Group on the application of space nuclear reactor power. I am very pleased to appear before you today and discuss the results of the work that we have been engaged in for the past year or so. I am going to summarize my statement, which I would like to submit for the record.

As you are aware, the National Aeronautics and Space Administration in partnership with the Department of Defense and the Department of Energy has been engaged in assessing and advancing space nuclear reactor power systems technology since February 1983. Dr. Truscello will give you a status report on that technology presently.

The Committee on Science and Technology has been understandably concerned because of the partnership with the Department of Defense, about the applicability of this technology to civil missions. As a result, NASA was directed by the House Authorization Report 98-65 to ensure that civil applications of space nuclear power were addressed adequately.

In response to this direction, the Civil Missions Advisory Group was formed with executive-level membership from NASA's three space flight centers, Marshall, Johnson, and Goddard, with two participating organizations, the Lewis Research Center and the Jet Propulsion Laboratory, as well as from the major NASA headquarters user offices. Daniel Herman, from the Office of Space Station, was the chairman, and the Office of Aeronautics and Space Technology, which is funding the program, provided the executive secretary.

I would like to add here that Mr. Herman sends his regrets that he cannot be here with you today. And the second comment that I would like to add is that while I was acting executive secretary during this committee's work, I am at this present time no longer with the Office of Aeronautics and Space Technology.

The civil missions advisory group commenced its work in September 1983 by reviewing the mission planning and definition activities of the SP-100 Program, followed by a survey of mission planning activities carried out by other organizations in NASA, by aerospace contractors and by universities.

More than 50 candidate missions were brought to the attention of this committee. All were critically reviewed by asking the following questions: What is the electrical power requirement of the mission; to what extent would the use of nuclear power enhance or enable mission performance or its practical implementation; are the mission objectives supported by established goals for space exploration or application and a clearly defined user community; and what is the likely timeline for mission implementation?

The civil mission set determined to be realistic for planning purposes included more than 10 missions in 5 categories. These were large manned or man-tended facilities in low earth orbit, large platforms in geosynchronous orbit, transportation between different orbits, planetary exploration, and finally, lunar and planetary bases.

An interim report containing the survey of the above missions was completed in March 1984 and submitted to the committee in May 1984.

The rest of the Civil Missions Advisory Group's work was devoted to the analysis of three mission areas considered most likely to first benefit from the use of nuclear power and to the assessment of the question whether such a power source could be used in civil space missions without endangering public safety.

The final report summarizing the group's findings and recommendations was forwarded to Chairman Fuqua in January 1985, and I would like respectfully to submit a copy for the record of this hearing.

Mr. STALLINGS. That would be fine.

Dr. AMBRUS. Before I detail the salient points of our report, I would like to briefly summarize the attributes of nuclear power which were used to evaluate its desirability for future civil missions. The power system whose technological foundation is being laid by the ongoing Tri-Agency SP-100 Program would provide power independent of sunlight in the multihundred-kilowatt range, with weight and volume constraints that would permit deployment requiring a single space shuttle launch and a maintenance-free life of 7 to 10 years. Against these advantages have to be weighed the time and cost of development and the public perception of its use.

Of all the civil missions reviewed, the manned space station in low earth orbit is the one of most immediate interest in view of NASA's new effort in this area. An investigation of this mission was undertaken by awarding a study contract to the Boeing Aerospace Co. The major tasks that they carried out under this contract were, first, to identify the requirements that would make the use of nuclear power source a desirable option; and second, to assess the impact of nuclear power source on the space station architecture with major emphasis on safety.

It was concluded that while the initial power demand, which at present is estimated to be about 75 kilowatts, and the growth projected through the following decade, which is projected to be about 300 kilowatts, could be met with solar arrays or by employing solar dynamic power sources, the next century could see missions that would benefit greatly by the type of power that nuclear reactors can provide.

Of particular interest would be the power-intensive manufacturing projects such as crystal growth, containerless glass and glass fiber processing, and large-scale production of pharmaceuticals. At this point, a nuclear reactor with its very high power and energy density might well be the most economical power source.

The result of the different architecture studies showed that placing the shielded reactor on a 70-meter boom would produce radiation low enough to allow manned operation while still being compact enough to be launched as a single shuttle launch.

The Civil Mission Advisory Group concluded that at power requirements above 300 kilowatts, nuclear reactor power source would be a serious contender for the advanced space station.

Another mission to benefit greatly from the availability of large amounts of power could be a communications platform in geosynchronous orbit. There are many new concepts in high data rate communications that will require a transmitter or repeater located in geosynchronous orbit. Such concepts include direct broadcast video, closed-circuit teleconferencing, electronic mail transmissions, and mobile communications.

If these concepts are implemented, the number of satellites in the desirable orbits could increase to unmanageable proportions. Nuclear reactor power with its high energy density again could enable these missions to be placed on a single platform which could perform a variety of functions. Such a platform is potentially very economical, allowing sharing of launch and operational costs among many commercial users.

Third, the area of planetary exploration was analyzed. Of special interest was found to be the difficult missions to the outer planets. While these planets can be reached by conventionally prepared spacecraft, as evidenced by our present Voyager mission, greatly enhanced missions could be undertaken if electric propulsion enabled by the high-power levels of nuclear reactors would be available. Time of flight can be significantly reduced while still delivering large scientific payloads.

In addition, exploratory missions could be carried out by orbiting spacecraft around planets. For instance, exploration of Saturn's rings is such a mission. This mission concept employs a nuclear-powered electric propulsion system that transports the payload from Earth to Saturn in about 8 years, which is a much shorter period than would be with conventional means.

Very important science questions have been raised by the spectacular observations of Saturn as seen by the Voyager spacecraft. The origin and evolution of the rings as relating to processes at work in the Saturn/satellite system is of great interest. A follow-on Saturn orbiter mission with capabilities similar to Galileo, which is our upcoming mission to Jupiter, will provide long duration, remote observations which should yield a better characterization of ring structures, dynamics, and possible satellite interaction. However, many questions dealing with the origin and processes of ring formation and the nature of ring particles will likely remain unsolved until it is possible to perform closeup experiments which will be enabled by nuclear power.

Finally, the safety aspects of using the nuclear reactor power source have been examined in detail. The Civil Missions Advisory Group is satisfied that all danger to public safety can be avoided by careful design and planning for every accident scenario at all stages of assembly, test, transportation, launch vehicle integration, launch, operation, and disposal.

A complete surety plan which includes safety safeguards, environmental protection, reliability, and quality assurance is receiving major emphasis in the SP-100 Program, and we are satisfied all technical questions are being adequately addressed. The question of public perception will have to be dealt with once the technical decisions are made to use this power source in civil missions.

In summary, then, the Civil Missions Advisory Group has concluded that there are at least three missions, potentially launched in the first decade of the next century, which would be significantly enhanced if a nuclear reactor power source were available. In addition, there are missions in the far term which would be enabled by employing nuclear electric propulsion. In our briefing to Mr. Beggs on December 20, 1984, we have therefore recommended that NASA continue to support the advancement of this technology with its long-term applicability in view and that the Civil Missions Advisory Group continue to provide inputs relative to civil mission requirements in the follow-on phases of the SP-100 Program.

Thank you for allowing me to discuss these matters with you.

[The prepared statement of Dr. Ambrus follows:]

February 21, 1985

Statement of

Dr. Judith H. Ambrus
Executive Secretary of the
Civil Missions Advisory Group

National Aeronautics and Space Administration

before the

Subcommittee on Energy Research and Production
Committee on Science and Technology
House of Representatives

Madam Chairman and Distinguished Members of the Subcommittee:

I am pleased to appear before you today and discuss, as you requested, the work of the Civil Missions Advisory Group.

As you are aware, the National Aeronautics and Space Administration, in partnership with the Defense Department and the Department of Energy, has been engaged in assessing and advancing space nuclear reactor power systems technology since February 1983. The Committee on Science and Technology had been understandably concerned about the applicability of this technology to civil space missions. As a result, NASA was directed via House Authorization Report 98-65 to ensure that civil applications of space nuclear power were addressed adequately. In response to this direction, the Civil Missions Advisory Group (CMAG) was formed with executive level membership from NASA's Space Flight Centers (Marshall Space Flight Center, Johnson Space Center and Goddard Space Flight Center), the Lewis Research Center and the Jet Propulsion Laboratory (the two participating organizations) as well as from the major NASA Headquarters Offices. The Group was chaired by Daniel H. Herman from the Office of Space Station, while the Office of Aeronautics and Space Technology, which manages the technology program (SP-100), provided the Executive Secretary.

The CMAG commenced its work in September 1983 by reviewing the mission planning and definition activities of the SP-100 program followed by a survey of mission planning activities carried out by other organizations in NASA, aerospace contractors, and universities. More than 50 candidate missions were brought to the attention of the CMAG. All were critically reviewed by asking the following questions: 1) what is the electrical power requirement of the mission, 2) to what extent would the use of nuclear power enhance or enable mission performance or its practical implementation, 3) are the mission objectives supported by established goals for space exploration/application and a clearly defined user community and 4) what is the likely timeline for mission implementation?

The civil mission set determined to be realistic for planning purposes included more than ten missions in five categories: 1) large manned or man-tended facilities in low earth orbit, 2) large platforms in geosynchronous orbit, 3) transportation between different orbits, 4) planetary exploration, and 5) lunar and planetary bases. An Interim Report containing the survey of the above missions was completed in March and submitted to the Committee in May 1984.

The rest of the CMAG's work was devoted to the analysis of three mission areas considered most likely to first benefit from the use of nuclear power and to the assessment of the question whether such a power source could be used in civil space missions without endangering public safety. The Final Report summarizing the Group's findings and recommendations was forwarded to Chairman Fuqua in January 1985.

Before I detail the salient points of our report, I would like to briefly summarize the attributes of nuclear power which we used to evaluate its desirability for future civil missions. The power system whose technological foundation is being laid by the ongoing Tri-Agency SP-100 program would provide power independent of sunlight in the multihundred kilowatt range, with weight and volume constraints that would permit deployment requiring a single Space Shuttle launch, and a maintenance free life of seven to ten years. Against these advantages have to be weighed the time and cost of development and the public perception of its use.

Of all the civil missions reviewed, the manned Space Station in low earth orbit is the one of most immediate interest in view of NASA's new effort in this area. An investigation of this mission was undertaken by awarding a study contract to the Boeing Aerospace Company. The major tasks that were carried out were: 1) to identify the requirements that would make the use of a nuclear power source a desirable option, and 2) to assess the impact of the nuclear power source on the Space Station architecture with major emphasis on safety. It was concluded that while the initial power demand (75 kilowatts) and the growth projected through the following decade (300 kilowatts) could be met with solar arrays and/or solar dynamic power sources, the next century could see missions that would benefit greatly by the type of power that nuclear reactors can provide. Of particular interest would be the power intensive manufacturing projects such as crystal growth, containerless glass and fiber processing, and the large scale production of pharmaceuticals. At this point, a nuclear reactor with its high energy density might well be the most economical power source. The result of the different architecture studies showed that placing the shielded reactor on a 70 meter boom would produce radiation low enough to allow manned operation while still being compact enough to be launched as a single Space Shuttle load. The CMAG concluded that at power requirements above 300 killowatts, nuclear reactor power would be a serious contender for the advanced Space Station.

Another mission to benefit greatly from the availability of large amounts of power could be a communications platform in geosynchronous orbit (GEO). There are many new concepts in high data rate communications that will require a transmitter/repeater located in GEO. Such concepts include direct broadcast video, closed circuit teleconferencing, electronic mail transmissions, and mobile communications. As these concepts are implemented, the number of satellites in the desirable orbits could increase to unmanageable proportions. Nuclear reactor power with its high energy density could enable these missions to be placed on a single platform which would perform a variety of functions. Such a platform is potentially very economical, allowing sharing of launch and operational costs among many commercial users.

Thirdly, the area of planetary exploration was analyzed. Of special interest were found to be the difficult missions to the outer planets. While these planets can be reached by conventionally propelled spacecraft, greatly enhanced missions can be undertaken if electric propulsion, enabled by the high power levels of nuclear reactors, is available. Time of flight can be significantly reduced while still delivering large scientific payloads. In addition, exploratory missions can be carried out by orbiting spacecraft around planets. Exploration of Saturn's rings, for example, is such a mission. This mission concept employs a nuclear-powered electric propulsion system that transports the payload from Earth to Saturn in about eight years.

Important science questions have been raised by the spectacular observations of Saturn's rings by the Voyager spacecraft. The origin and evolution of the rings as relating to processes at work in the Saturn/satellite system is of great interest. A follow-on Saturn orbiter mission with capabilities similar to Galileo will provide long duration, remote observations which should yield a better characterization of ring structures, dynamics and possible satellite interaction. However, many questions dealing with the origin and processes of ring formation and the nature of ring particles will likely remain unresolved until it is possible to perform close-up (in situ) experiments.

The primary objectives of this advanced mission to rendezvous with Saturn's rings are to conduct detailed observations of individual ring particles and in situ composition measurements of the particles and their immediate environment. This will require spacecraft systems with enormous propulsive capability. Chemical propulsion systems are not adequate to attain near-circular orbits even at the outer edge of the ring system. This mission requires a high performance low-thrust system which, at Saturn's distance from the Sun, is enabled only by a nuclear power source. Others in this advanced category are collection and return of samples from the nuclei of comets and from asteroids, and other outer planetary orbiter and probe missions.

Finally, the safety aspects of using a nuclear reactor power source have been examined in detail. The CMAG is satisfied that all danger to public safety can be avoided by careful design and planning for every accident scenario at all stages of assembly, test, transportation, launch vehicle integration, launch, operation and disposal. A complete surety plan (which includes safety, safeguards, environmental protection, reliability and quality assurance) is receiving major emphasis in the SP-100 program and all technical questions are being addressed adequately. The question of public perception will have to be dealt with once the technical decisions are made to use this power source in civil missions.

In summary then, the Civil Missions Advisory Group has concluded that there are at least three missions, potentially launched in the first decade of the next century, which would be significantly enhanced if a nuclear reactor power source were available. In addition, there are missions in the far term, which would be enabled by employing nuclear electric propulsion. In our briefing to Mr. Beggs on December 20, 1984, we have, therefore, recommended that NASA continue to support the advancement of this technology with its long term applicability in view and that the CMAG continue to provide inputs relative to civil mission requirements in the follow-on phases of the SP-100 program.

Thank you for allowing me to discuss these matters with you.

Biography
Dr. Judith H.Ambrus

Dr. Judith H. Ambrus graduated with a Bachelor's Degree in chemistry and physics from the Eotveos Lorand University for Sciences in Budapest, Hungary in 1954. After leaving the country in 1957, she settled for some years in Johannesburg, South Africa, where she was employed by the South African Railways and Harbors in the capacity of junior chemist concerned primarily with developing instrumental analytical methods for petroleum products. She came to the United Stated in 1960, where she taught chemistry and physics at the high school level for two years, then enrolled in the graduate program of the University of Maryland. After receiving a Master's Degree in chemistry in 1966, she joined the Naval Ordnance Laboratory (now the Naval Surface Weapons Center) as a research chemist, where she conducted basic and applied research in electrochemistry as applied to energy storage batteries. She progressed from research chemist to project leader while continuing her education part-time and received her PhD in 1970 from the University of Maryland. She was appointed the Head of the Electrochemistry Branch in 1974, which under her leadership, became the Navy's Center of Excellence in Battery R&T spanning all activities in electrochemical batteries from basic investigation through advanced development to battery design and testing for weapons application. During this period of time, she spent a training year on assignment to the staff of the Director of Navy Laboratories.

She joined NASA in 1980 as a program manager in the Space Energy Conversion Office, Office of Aeronautics and Space Technology. Her duties there included the management of NASA's R&T program in electrochemistry (batteries and fuel cells) as well as thermal to electric conversion. In this capacity, she has managed all activities related to the interagency program in space nuclear power since its inception. In October 1984, she joined NASA's newly formed Office of Space Station, where she is serving in the capacity of Systems Engineering Manager for Power, Propulsion, Thermal Management, and Environmental and Life Support System.

Dr. Ambrus has published widely in the area of basic electrochemisty, naval applications of electrochemical batteries and, more recently, on the subject of space energy systems. She holds several awards for outstanding performance including the Navy's Meritorious Civilian Service Award and NASA's Exceptional Service Award. She is active in the Electrochemical Society and the American Institute of Aeronautics and Astronautics.

Mr. STALLINGS. Thank you very much.

Dr. Truscello.

STATEMENT OF DR. VINCENT TRUSCELLO, JET PROPULSION LABORATORY

Dr. TRUSCELLO. Mr. Chairman, thank you very much for the opportunity to testify today. I am Vincent Truscello, manager of the SP-100 Project. I represent a project team that includes the Jet Propulsion Laboratory, Los Alamos National Laboratory, the Lewis Research Center, the Oak Ridge National Laboratory, and the Hanford Engineering Development Laboratory.

Mr. Chairman, I have prepared a detailed statement for the record, and with your permission I will submit it and present here just a very brief summary.

Our goal is very simple: To have our country use nuclear reactor power in space. To meet our goal we are making extensive use of all the national resources, including the legacy of previous space nuclear programs, a data base for such programs as LMFBR, solar and conservation programs, and RTG efforts. Also, we're using the reservoir of engineering talent that's in industry as well as at the Government laboratories. Indeed, I believe we have reassembled a very expert team.

Our performance objectives are quite demanding. For instance, a 100-kilowatt system must weigh less than 3,000 kilograms. Its lifetime must be greater than 7 years. We want a very compact system when stowed within the cargo bay of the shuttle, and moreover it must be suitable in the power range of about 50 kilowatts up to 1,000 kilowatts.

Our overall schedule is given in my written statement, and I will just summarize it here.

Presently, we are in the last year of a 3-year effort known as proof of concept, or feasibility phase. This phase includes concept definition studies, and for each of the concepts we have identified critical technologies. By the end of this fiscal year we will have evaluated all the data, including the concept studies and the development of the critical technologies, and we will select a system concept for ground demonstration.

By 1991, which will be the end of the ground demonstration phase, we expect to have proven technical readiness of hardware that would be suitable for a flight program. And moreover, it's very important that this would be hardware that would meet our very demanding performance objectives.

Our industry contractors are presently studying three different concepts. In-core thermionics is being studied by the team of Martin-Marietta and GA Technologies. Thermoelectrics is being studied by General Electric, and Stirling-Rockwell International.

Each has unique advantages, but each poses very severe challenges. Our present work is to determine if these challenges can indeed be met.

During this initial phase, this concept definition phase, we are stressing a number of areas. First of all, the contractors are being extremely innovative, I believe, in coming up with designs that do meet our stringent performance requirements. At the same time, however, they are taking great care that they do not introduce any weak links, those links that would compromise the intrinsic safety and the intrinsic survivability of this device. Indeed, safety is being given the highest priority during all phases of this effort.

It's also important to know that we are not concentrating on any one single power level, but have given instructions to our contractors to characterize a range of systems from 50 to 1,000 kilowatts. It's our intent, in fact, by the end of 1991, the end of our demonstration phase, to put a technology base in place that is applicable to this entire power range.

Development costs are also important to us, and our contractors have been asked to generate the costs for the next phase, and this is being done by them in some detail.

The final point I would like to make with regard to this area I think is very important. And that is, we are doing a great deal more than simply paper studies with some supporting analysis. We have, in fact, fabricated a large number of key elements of the power system for all the concepts that are under evaluation. And we are placing these technologies on test to demonstrate their feasibility.

In the interest of time, I will select only a few examples, but the details of all of my examples are given in my written statement.

Let me first discuss very briefly the thermoelectric system, concentrating for a moment on the reactor part of that system. The key element there is the fuel pin. We have fabricated a number of fuel pins, and in fact we've really reinstated the technology base that had been lost over the last 10 years, that technology base, to build refractory metal fuel pins and uranium nitride fuel pellets. A number of these pins at this moment are on test in the EBR–2 reactor at Idaho.

The key element of the non-nuclear part of the thermoelectric system is the thermoelectric power conversion assembly. We are presently fabricating a small section of this assembly to demonstrate the feasibility of being able to achieve high efficiency, compactness, low weight, and most importantly, low cost. Hardware results should be available to us very shortly.

Turning now to the thermionic system, the heart of that device is the thermionic converter which is embedded within the core of the reactor. There are about 1,000 of these units in a 100-kilowatt reactor, as an example. Each produces about 100 watts of power.

We have also reinstated the converter fabrication technology. A number of these converters are at present on test within a reactor, and we're accumulating data regarding the rate at which these converters degrade in the severe reactor environment. Our aim is to determine the design parameters that will give acceptable performance.

The last system I want to discuss is the Stirling. The key element in that system is the Stirling engine. There are five engines housed within a 100-kilowatt system, each producing about 25 kilowatts of electricity.

We are presently fabricating a 25-kilowatt converter. This is very significant in that it will be the largest such unit to ever have been fabricated. In fact, up to this point the largest unit was a 3-kilowatt unit.

In addition, we have one of those 3-kilowatt units on life test, and we've accumulated to date about 2,500 hours of tests without any deterioration of the system.

In conclusion, I want to say that the project is very much on track. We are producing a great deal of hardware, as well as developing system concepts and doing analysis. We fully expect to use this large body of information to select a system in the fall of this year.

Also, we're preparing an RFP, which we expect to release to industry about October of this year.

Mr. Chairman, thank you for the opportunity to present the status of the SP-100 project.

[The prepared statement of Dr. Truscello follows:]

**HOLD FOR RELEASE UNTIL
PRESENTED BY WITNESS
FEBRUARY 21, 1985**

Statement of

Dr. Vincent C. Truscello
Manager, SP-100 Project
Jet Propulsion Laboratory

before the

Subcommittee on Energy Research and Production
Committee on Science and Technology
House of Representatives

Madam Chairman and Members of the Subcommittee:

Thank you for the opportunity to testify today. My name is Vincent Truscello, and I am manager of the SP-100 Project. I represent a project team that includes the Jet Propulsion Laboratory, the Los Alamos National Laboratory, the Lewis Research Center, the Oak Ridge National Laboratory, and the Hanford Engineering Development Laboratory.

The goal of the SP-100 Project is to have reactor power systems used in space missions requiring enhanced power capabilities (Figure 1). To meet this goal, we are making extensive and cost-effective use of the existing national resources (Figure 2).

These resources include

(1) The legacy left by the previous space nuclear power programs, which ended in 1973;

(2) The considerable data base acquired from 1973 to 1983 in related technology development programs such as the fast-spectrum reactor program (Liquid Metal Fast Breeder Reactor), the solar and conservation programs, and the ongoing space isotope power programs, which use radioisotope thermoelectric generators (RTGs); and

(3) The significant reservoir of experienced engineering talent in industry and in government laboratories.

From this reservoir, we have successfully reassembled an expert team.

Using this past experience primarily as a technology springboard, we have set our power system performance goals significantly higher than was thought possible 10 years ago (Figure 3). The higher goals, of course, require the development of an extensive amount of new technology. We feel it is necessary to develop this technology to assure a competitive posture against alternative power system approaches and, most importantly, to significantly support the enhancement of this nation's future space mission abilities.

The overall schedule of our program is quite orderly, yet aggressive (Figure 4). We are presently completing Phase I efforts to establish concept feasibility. By the end of this technology assessment and advancement phase (approximately July 1985), we expect to have convincing evidence that a nuclear power system can indeed be developed to meet the stringent performance requirements. I strongly believe we will be able to meet this important milestone. The next phase, the ground engineering systems demonstration, is also critical in the pursuit of our goal. Its purpose is to produce technical readiness and to put the technology largely in place to allow the third phase, flight application, to occur.

During this first phase, three power system concepts are being studied. Our industry team consists of three major aerospace companies and associated nuclear reactor companies. Martin Marietta/GA Technologies is developing the thermionic concept, General Electric is developing the thermoelectric concept, and Rockwell International is developing the Stirling concept (Figure 5). All three concepts use a fast spectrum reactor with liquid metal cooling. These system contractors are supported by a host of subcontractors performing the detailed work on many of the subsystems.

There is no obvious prime candidate among these three concepts. Each has certain advantages, yet each poses difficult challenges (Figure 6). Thermionic systems have had an extensive development history, although they have never been used in space. These static converter systems potentially allow graceful degradation. Another important aspect is that only the fuel and its clad--which also acts as the electron emitter--are at high temperature (the highest of any of the three systems); the remaining parts of the reactor and cooling loop are at relatively low temperature (1000 K). The major challenge, however, is that the thermionic converters are internal to the reactor core and, consequently, are subject to its severe thermal and radiation environment.

Thermoelectric converters, on the other hand, are external to the reactor core. These static converters have a proven history in previous space flights and have demonstrated long lifetimes (eight years) with graceful degradation. Because the thermoelectric coverters are external to the reactor core and must operate at relatively high temperatures (approximately 1300 K) for acceptable performance, the entire reactor core and coolant loop must also operate at high temperatures. The greatest challenges posed by thermoelectrics are to improve the conversion efficiency and reduce the weight and cost of state-of-the-art converters.

Because the conversion efficiency is high, Stirling engines offer the option of providing low reactor operating temperatures. Thus, if the higher end of the operating temperature range is used (1000 to 1150 K), the refractory clad materials would be subjected to low stresses; if the lower range in operating temperature is used (900 to 1000 K), more conventional materials, such as stainless steel, could be considered. In either case, a lower risk reactor development program is expected since direct use of the extensive Liquid Metal Fast Breeder Reactor technology would be possible. The major challenges, however, are using high-speed moving parts with unproven lifetimes and using high-pressure heat exchangers to transfer the heat from the reactor coolant to the 2500-psi-engine working fluid (helium).

More recently, for completeness a fourth concept has been included for evaluation, although it will not be discussed extensively here. Earlier studies have shown that this fourth concept, the Brayton power system, is less attractive than the other three concepts. The Brayton system would use a reactor similar to the one used on the thermoelectric power system, but the thermoelectric conversion units would be replaced by a set of dynamic conversion machines known as Brayton units. One of these units has already been built and tested (for approximately 40,000 hours) in the 1970s, thus demonstrating its feasibility. Rockwell International (one of our contractors), under its own funding, is performing concept development of the Brayton power system.

Over the last two years, the three primary concepts have been studied extensively by our industry teams. Major areas emphasized during the concept definition phase include nuclear safety, survivability, performance, growth potential, technology development, and costs (Figure 7). Prime consideration has been given to user needs, which provide the top-level constraints on the evolving design. Potential military and civilian mission applications have been investigated to determine the effect of the user requirements on the reactor power system as well as the effect of the reactor power system on the spacecraft. Results indicate that this user interface can be adequately addressed.

Safety is the primary concern during this phase and will remain so during all phases. We are stressing safety, even during this conceptual phase, because we want these systems to be inherently safe through good design and operational practice. For example, the reactor power system will be launched cold, thus containing essentially no radioactive inventory at launch. The SP-100 system will not be turned on and operated until it achieves a long-lived stable orbit. Moreover, the system is designed to survive the potentially severe accident environment during the launch phase without any hazardous consequences. The ruggedness of the reactor makes intrinsic safety feasible.

Besides being inherently safe, nuclear reactor power systems have intrinsic hardness to the natural environment and can operate in the hostile regions of space against Van Allen electrons, micrometeoroides, and space debris. Contractor work is stressing survivability activities in order to preclude design features that might produce a weak link and compromise the system's intrinsic hardness. The contractors are also studying the survivability of these systems in the potentially more stressful man-made environment. Although the nuclear power system, by nature, is significantly harder to this environment than are its competitors, design features can be incorporated--albeit with a weight or performance penalty--to produce even greater resistance to potential man-made threats associated with military applications of this technology.

In addition, our contractors have been exceptionally innovative and are stressing design features that support the achievement of our very difficult performance goals. Design features are being investigated that will enable these power systems to be built and operated at power levels ranging from 50 to more than 1000 kWe with essentially the same technology.

Preliminary estimates indicate that the specific performance will increase from 30 W/kg at 100 kWe to nearly 60 W/kg at 1000 kWe. A 1000-kWe power system will occupy the entire length of the Space Transportation System cargo bay; a 100-kWe system will occupy only one-third of the cargo bay. The higher power levels will necessitate multiple shuttle launches and on-orbit mating with the orbital transfer vehicle and mission spacecraft.

Supporting the evolution of the conceptual design is an extensive technology development effort to verify the technical feasibility of a number of key design features. It is these features that make possible the predictions of our aggressive performance goals. Thus, verification of these features is essential. The rest of this presentation describes the key technology-enhancing features of each system and the progress made toward demonstrating their feasibility.

THERMOELECTRIC CONCEPT

The major elements of the thermoelectric system (Figure 8) are (1) a fast-spectrum reactor made of refractory metal (niobium-zirconium), (2) a shadow shield that attenuates both neutrons and gammas and protects the satellite electronics from the harmful radiation emitted by the reactor (lithium-hydride/tungsten), (3) a pumped heat transport loop that transfers heat from the reactor to a power conversion device by means of a liquid metal (lithium), (4) a solid-state power conversion package that transforms the reactor thermal power to electricity (lanthanum-sulfide/lanthanum-telluride), and (5) the largest and most visible component of the system, a waste heat radiator that dissipates the unconverted energy to space (beryllium structure with titanium/potassium heat pipes).

The key technology issues for the nuclear components of the thermoelectric system are (1) the refractory metal fuel pins, (2) the ability to start the reactor in space with a frozen (solid) coolant, and (3) the need for highly efficient and lightweight self-actuating thermoelectric coolant pumps (Figure 9). Although a refractory metal reactor has never been built, some experience with refractory metal fuel pins was gained in earlier technology programs and was used as the initial springboard for design. The earlier data base was inadequate because of lack of data in the appropriate temperature range and because of differences in the neutron irradiation spectrum (thermal vs fast). In January 1985, a group of fuel pins was inserted into EBR-II, one of only two fast-spectrum reactors in the country. Preliminary data from this accelerated irradiation program are expected in April or May 1985. As part of the fuel-pin fabrication, the U.S. technology to produce uranium-nitride pellets was reestablished. This was a significant accomplishment in just a short period of time. Complementary compatibility experiments to the in-reactor tests are being conducted in the laboratory on the materials of construction. The long-term behavior of the combination of fuel, cladding, and coolant is being estimated from these experiments and interpreted by application to sophisticated life models developed over the past 10 years.

Because essentially no data exist regarding the long-term behavior of refractory metals in a fast-spectrum neutron environment, a series of experiments is currently under way to characterize a group of candiate refractory metals, both before and after irradiation, for potential deterioration of properties. One of these important parameter tests, long-term creep, is actually being conducted during the irradiation cycle. This work also includes the characterization of previously irradiated samples that have been in storage for more than 10 years within their original irradiation capsule.

A major concern with the thermoelectric system is the problem of coolant thawout during the initial startup. Although the use of lithium as the coolant in the reactor has a number of significant advantages, we remain concerned by two properties of lithium: the fact that it is still frozen at relatively high temperatures (as compared to sodium-potassium, for instance) and that it expands as it melts. Initial analysis indicates that it will be possible to start up the reactor, even with frozen lithium in the core, but this analysis must be confirmed by experiment. Subscale mockups of the reactor core are currently being prepared for testing to determine the feasibility of this concept.

The self-actuating coolant pumps are also components that need to be experimentally verified. These pumps extract a portion of the heat from the coolant and convert this heat to an electromagnetic motivating force by the use of thermoelectric elements. Experimental versions of these pumps are currently in fabrication to demonstrate their feasibility.

The power conversion and waste heat subsystems also contain key technology issues that require verification (Figure 10). The main power conversion issues are how to (1) produce an improved conversion efficiency, (2) develop a compact, lightweight, low-cost thermoelectric conversion package, and (3) accomplish both of the above without sacrificing long-term performance stability. To date, all space nuclear power systems (all but one are RTGs) have used thermoelectric conversion. This method has proved to be highly reliable; in actual space experience exceeding eight years, only minimum deterioration occurred. Indeed, such systems degrade quite gracefully. However, the use of the technology base that has been developed for RTGs would result in a power conversion package that is too heavy and expensive. Work is in progress to increase the conversion efficiency by a factor of two and to reduce the size of the thermoelectric package by a factor of twenty or more. Some improvement in efficiency has already been attained (for example, the negative leg of the thermoelectric couple has been increased by 40% over state of the art). But much has yet to be done to get a complete high-performance couple. A design has already been completed for a compact thermoelectric package, and some of its key features have been experimentally verified. In addition, a thermoelectric cell containing 25 thermocouples metallurgically bonded into a compact assembly is expected to be fabricated and tested within the next several months. A 100-kWe power system would contain approximately 8000 of these cells. Compatibility analysis and accelerated material diffusion experiments are under way to verify the long-term stability of this high-performance design.

The primary features of the waste heat radiator are the hundreds of heat pipes that uniformly distribute the heat and a flexible thermal coupler that interconnects the fixed and deployable portions of the radiator. Although heat pipes have been around for some time, a unique aspect of these pipes is their long length. Confirmation of the performance of these pipes is being accomplished through analytic models that are being bench-marked against experiments currently in process. Heat pipes 2 and 4 m in length have been fabricated and are now under test. In addition, an array of smaller pipes is under long-term life testing to confirm the chemical stability of these devices. The experimental data will be used to bench-mark the chemical stability codes currently under development for long-term performance predictions.

The flexible coupler that connects the fixed and deployable portions of the waste heat radiator is another area of concern. This device (a flexible heat pipe) must not only be capable of operating at around 800 K, but must also be able to bend 180 degrees during stowage and, after deployment, be capable of conducting the waste heat to the deployable portion of the radiator. A device that incorporates all of the essential features has been designed and is in fabrication. Verification analysis and proof-of-concept testing should be completed by May 1985.

THERMIONIC AND STIRLING CONCEPTS

The other two power system concepts (thermionic and Stirling) have many of the same design features and resulting technological problems as the thermoelectric system. For instance, they all contain similar fuels and use refractory metal cladding, electromagnetic pumps for heat transport, and heat pipes for waste heat dissipation. However, there are a number of features that introduce a different array of technological issues. The remainder of this presentation concentrates on these differences.

Thermionic Concept

Externally, the thermionic concept looks similar to the thermoelectric concept (Figure 11). Both contain a reactor, a shadow shield, and a large conical waste heat radiator. However, there is a major difference--on the thermionic system, the power conversion package is internal to, and an integral part of, the reactor. Thus, the coolant exiting the reactor is at the heat rejection temperature, and the reactor structure and coolant loops are at a significantly lower temperature than for the thermoelectric system (1000 vs 1350 K).

The key feasibility issue with the thermionic system deals with the high-temperature operation of the fuel/emitter/collector assembly known as the thermionic converter (Figure 12). A 100-kWe power plant contains more than 1000 of these units. Two basic concerns arise. During the fission process, gases are generated, causing mechanical swelling of the fuel and distortion of the thin (0.070-in.) refractory metal clad, which also acts as the electron emitter. Spaced a short distance from the emitter (approximately 0.02 in.) is the electron acceptor (collector). This very small gap is needed for proper operation of the converter. However, the mechanical distortion due to swelling can cause this gap to close and short-circuit the two electrodes, thus causing that converter to fail. Tests conducted more than 10 years ago indicated that this shorting would occur in less than two years. However, those converters operated at higher temperature and with smaller gaps (0.010 in.). Converters with larger electrode gaps have been fabricated, and several are already being tested. The results will help us determine the optimum combination of clad thickness, operating temperature, and electrode gap to prevent shorting over the system operating lifetime.

The other key concern with the thermionic converter is degradation of the ceramic insulators. Earlier tests indicated that under neutron exposure the ceramics used at that time (aluminum oxide) would swell and crack, lasting less than two years. However, the Department of Energy fusion program has identified two ceramics that undergo little or no swelling (yttria oxide and yttria-alumina garnet). More recently, under the SP-100 Project an irradiation capsule in storage for the last 10 years was opened in a hot cell for examination. This capsule, which had undergone irradiation at levels typical of the SP-100 environment, revealed that a ceramic sheath assembly made of yttria oxide had survived. Current experiments are extending this data base to verify (1) that these two ceramics will be compatible with the cesium vapor that exists in the interelectrode gap and (2) that a sheath irradiated by neutrons in both a thermal and an electric field will survive. The earlier experiment did not test for the electric field.

As an aid in assuring converter lifetime, work is under way to improve the performance of converters with large electrode gaps. As the electrode gap is increased to account for fuel swelling/emitter distortion, its performance degrades. To compensate for this degradation, electrodes better than the state of the art are necessary (for example, oxygenated collectors). Work is under way to prove the feasibility of such high-performing electrodes.

Stirling Concept

The Stirling system is very similar to the thermoelectric system in that the heat is transported from the reactor to an external power conversion package (Figure 13). Instead of 8000 solid-state conversion units, the package would consist of four to five dynamic machines known as free-piston Stirling engines. The major advantage of the Stirling system over the other two systems is its high conversion efficiency (20% compared to 6-10%). This allows the reactor to be quite a bit smaller and to operate at much lower temperatures (fuel clad temperatures are 300-500 K cooler than thermoelectric and 600-800 K cooler than thermionics). With these lower temperatures, the reactor is significantly less stressed, and it may even be possible (at the lower temperature) to construct the reactor from more conventional materials (like stainless steel) rather than from refractory metals.

The real unknown in such a system is the performance and lifetime of the dynamic machine. The key concerns are scale increase, thermodynamic efficiency with small temperature differences, dynamic balance, and lifetime (Figure 14). The largest free-piston machine built to date is 3 kWe. Under the SP-100 technology development program we are currently fabricating a 25-kWe engine. Many of the parts have already been completed, and testing should begin in May 1985. Previous systems have all operated with a large temperature difference between the heater and cooler of the engine ($T_h/T_c > 3$). In space, a temperature ratio less than two is necessary to achieve a reasonable system weight. The test in May will verify the feasibility of maintaining high thermodynamic efficiency with low-temperature ratios.

Although the concept of hydrostatic bearings has been demonstrated in the laboratory on small machines (3 kWe), the concept of a self-accuated hydrostatic bearing has not. This concept should also be verified in May. Since the free-piston Stirling is essentially a mechanical oscillator, vibration-induced motion due to the 100-Hz oscillation may be a problem on future satellites. An experiment was conceived to demonstrate that this motion could be totally eliminated through a vibration damper. The experiment was an unqualified success. Moreover, the 25-kWe engine is being designed with inherent dynamic balance because it uses two pistons in 180-degree phase opposition.

Finally, the question of lifetime is a major uncertainty. Although the machine has hydrostatic bearings, very little data exist on the long-term life of a mechanical oscillator. As part of this program, a 3-kWe free-piston machine is being tested. To date, this machine has been tested more than 2500 hours without any deterioration in performance. We expect to have 5000 to 6000 hours of test data by the time of system selection. The long-term viability of high-pressure heat exchangers is also a concern. Here we are counting on both careful and innovative design practices to minimize potential leaks.

CONCLUSION

In conclusion, I want to state that the project is very much on track (Figure 15). Results of the series of technology feasibility experiments expected to be completed over the next few months will significantly improve our earlier technology data base and provide us with the information required to evaluate the three concepts and select the best system for further development. I feel confident that by the end of this phase we will have convincing evidence that a nuclear reactor power system can indeed be developed to meet the presently specified performance requirements. We fully expect to announce concept selection this fiscal year and are planning to issue a request for proposal to industry on or about October for the design and development of the ground demonstration system.

Thank you for allowing me to discuss the status of the SP-100 Project with you.

THE GOAL OF THE SP-100 PROJECT

TO DEVELOP NUCLEAR POWER FOR SPACE

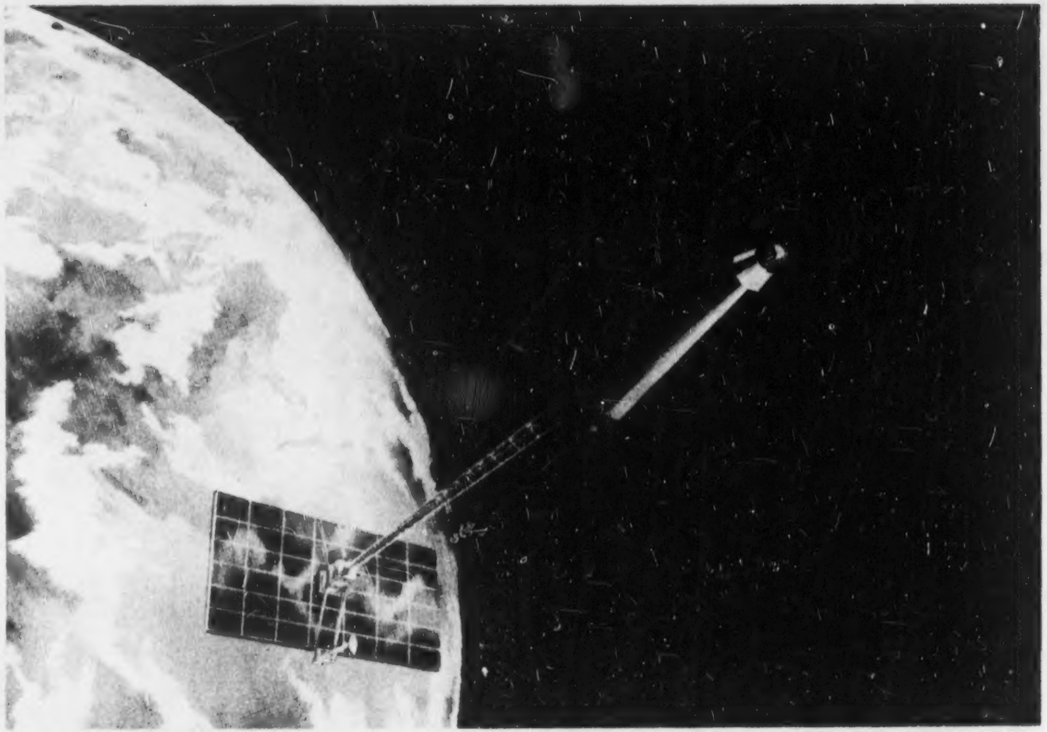


FIGURE 1

EXTENSIVE USE OF NATIONAL RESOURCES IN MEETING GOAL

- LEGACY OF PREVIOUS SPACE NUCLEAR PROGRAM
- DATA BASE FROM RELATED TECHNOLOGY PROGRAMS (1973-1983)
  - FAST SPECTRUM REACTOR PROGRAM
  - SOLAR AND CONSERVATION PROGRAMS
  - SPACE ISOTOPE POWER PROGRAM (RADIOISOTOPE THERMOELECTRIC GENERATORS, RTGs)
- RESERVOIR OF ENGINEERING TALENT IN INDUSTRY AND IN GOVERNMENT LABORATORIES
  - REASSEMBLED AN EXPERT TEAM

FIGURE 2

PERFORMANCE GOALS

- > 30 W/kg (AT 100 kWe)
- > 7-YEAR FULL POWER LIFE
- < 1/3-SHUTTLE CARGO BAY LENGTH (AT 100 kWe)
- POWER RANGE 50 kWe TO 1000 kWe (WITHIN ONE SHUTTLE)

FIGURE 3

THE SP-100 DEVELOPMENT SCHEDULE

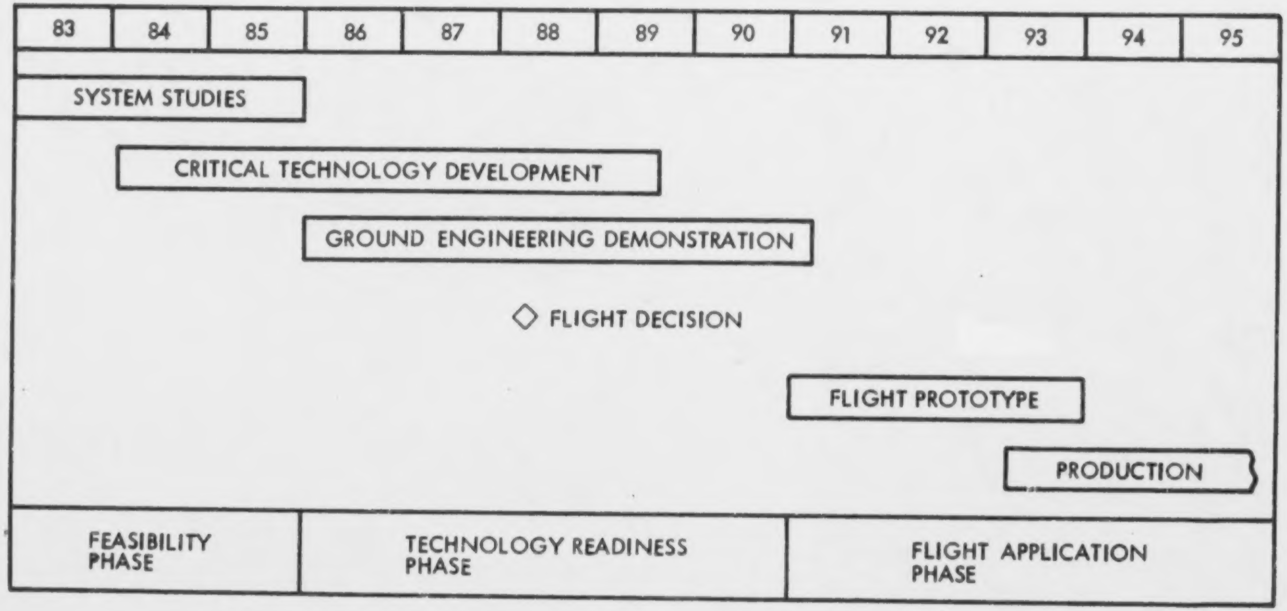
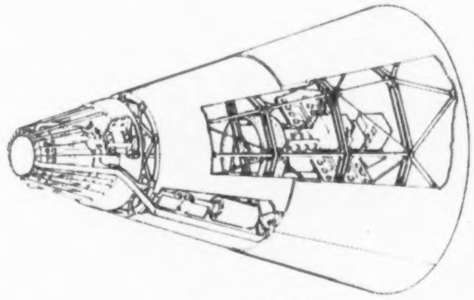
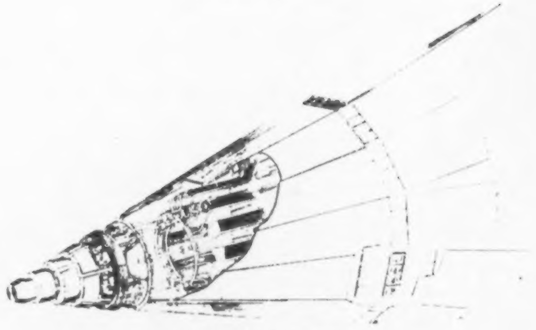


FIGURE 4

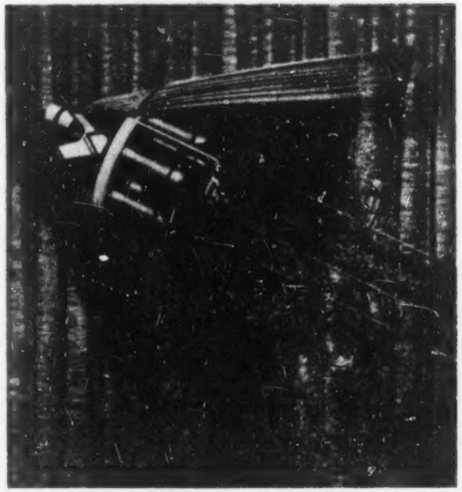
THE THREE POWER SYSTEM CONCEPTS



THERMIONIC



THERMOELECTRIC



STIRLING

FIGURE 5

COMPARISION OF CONCEPTS

CONCEPTS	INDUSTRY TEAMS	ADVANTAGES	CHALLENGES
THERMIONIC	MARTIN MARIETTA/ GA TECHNOLOGIES	• STATIC CONVERSION • GRACEFUL DEGRADATION POSSIBLE • LOW TEMPERATURE REACTOR STRUCTURE (1000K) • EXTENSIVE DEVELOPMENT FROM EARLIER SNP PROGRAM	• HIGH CLAD TEMPERATURE (1700K) • CONVERTER INCORE SUBJECT TO SEVERE STRESSES
THERMOELECTRIC	GENERAL ELECTRIC	• STATIC CONVERSION • PROVEN TECHNOLOGY IN PREVIOUS SPACE SYSTEMS • GRACEFUL DEGRADATION DEMONSTRATED IN FLIGHT SYSTEMS	• MEDIUM CLAD TEMPERATURE (1400K) • LOW EFFICIENCY, HEAVY, AND COSTLY CONVERTERS
STIRLING	ROCKWELL INTERNATIONAL	• HIGH CONVERSION EFFICIENCY • LOW CLAD TEMPERATURE (1100K)	• SIZE SCALE UP • HIGH SPEED MOVING PARTS-UNPROVEN LIFE TIME • HIGH PRESSURE HEAT EXCHANGERS • GRACEFUL DEGRADATION NOT PROBABLE

FIGURE 6

CONCEPT DEFINITION PHASE ACTIVITIES

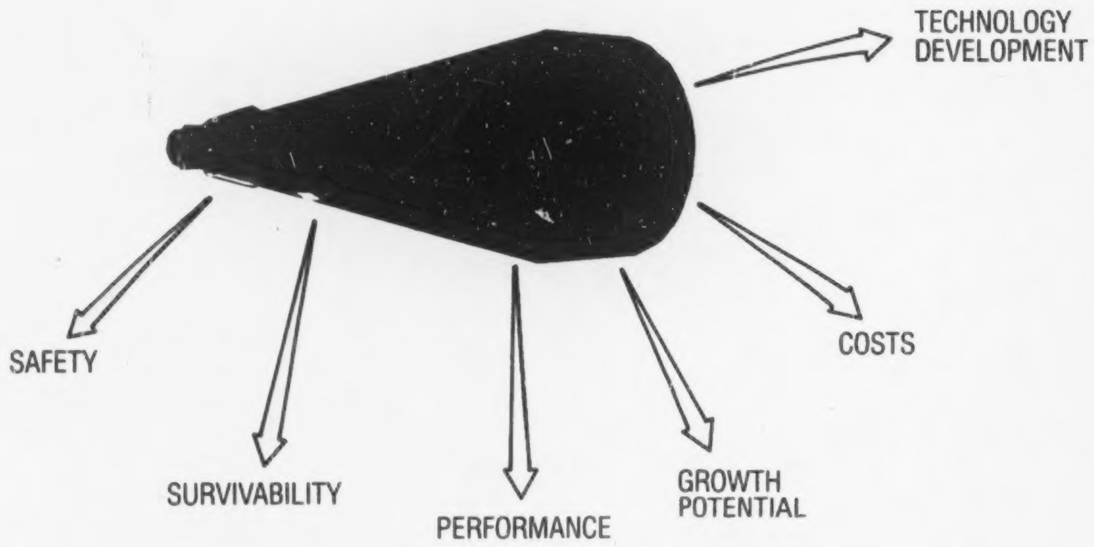

TECHNOLOGY DEVELOPMENT
COSTS
GROWTH POTENTIAL
PERFORMANCE
SURVIVABILITY
SAFETY

FIGURE 7

THERMOELECTRIC CONCEPT

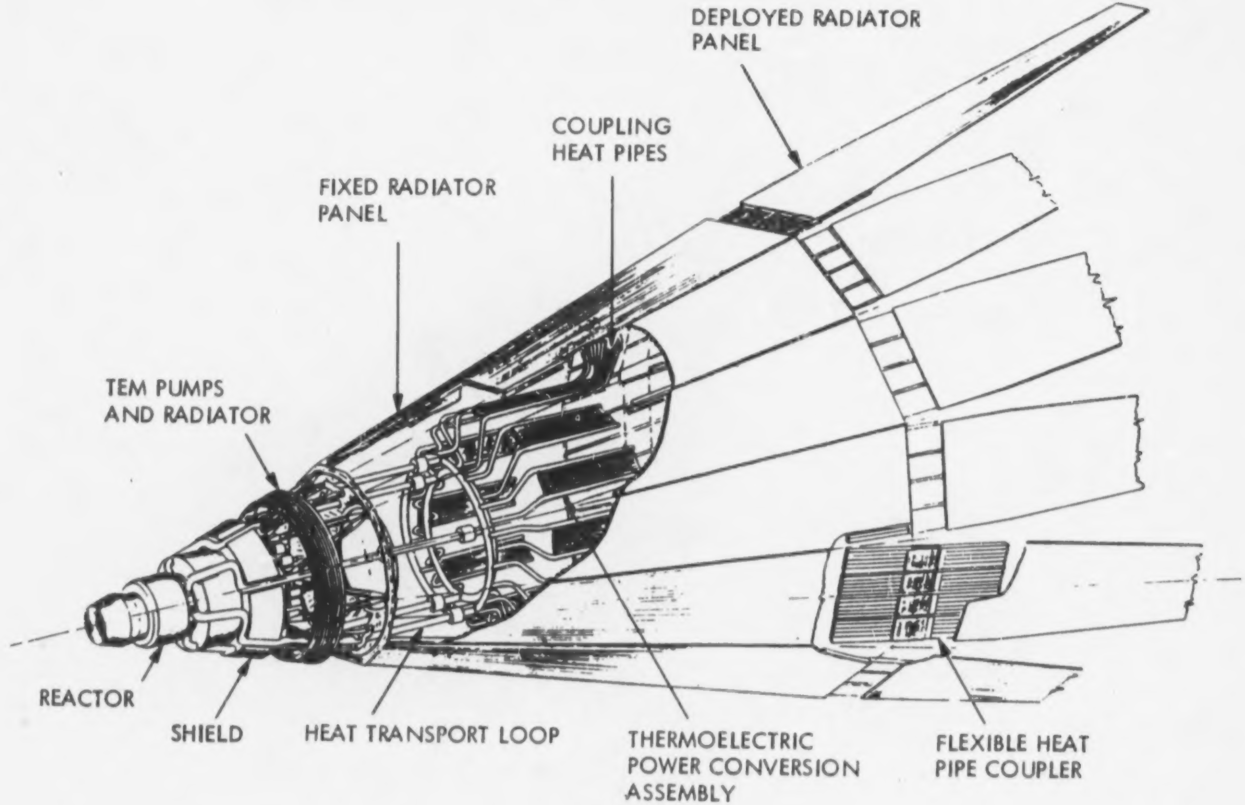
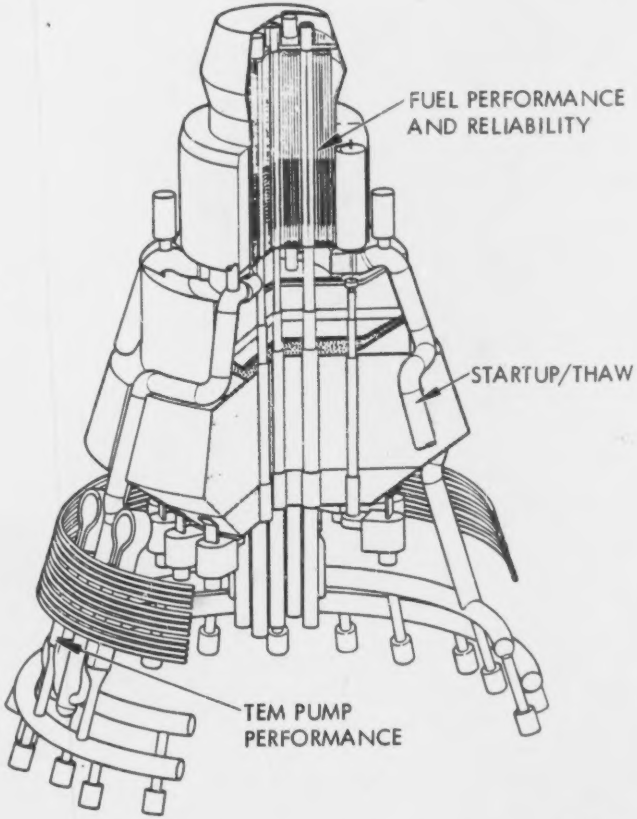

DEPLOYED RADIATOR PANEL
COUPLING HEAT PIPES
FIXED RADIATOR PANEL
TEM PUMPS AND RADIATOR
REACTOR
SHIELD
HEAT TRANSPORT LOOP
THERMOELECTRIC POWER CONVERSION ASSEMBLY
FLEXIBLE HEAT PIPE COUPLER

FIGURE 8

THERMOELECTRIC FEASIBILITY ISSUES (REACTOR)

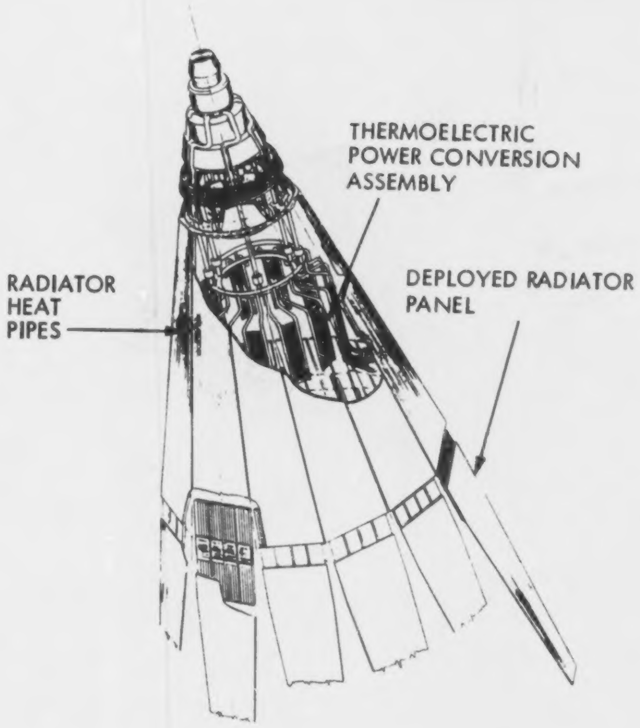

FUEL PERFORMANCE AND RELIABILITY
STARTUP/THAW
TEM PUMP PERFORMANCE

- FUEL PIN PERFORMANCE
  - TEST PINS IN REACTOR FOR SWELLING AND COMPATIBILITY
  - MATERIAL COMPATIBILITY BENCH TESTS
  - REFRACTORY METAL CHARACTERIZATION
- COOLANT THAWOUT
  - LITHIUM FROZEN AT LAUNCH
- COOLANT PUMPS
  - SELF ACTUATING THERMOELECTRIC ELECTROMAGNETIC (TEM) PUMPS

MAJOR RESULTS TO DATE
• REINSTATED TECHNOLOGY TO BUILD REFRACTORY METAL FUEL PINS AND URANIUN NITRIDE FUEL PELLETS • PINS IN REACTOR FOR TEST • MATERIAL TESTS WELL UNDERWAY

FIGURE 9

THERMOELECTRIC FEASIBILITY ISSUES
(CONVERTER/RADIATOR)


THERMOELECTRIC POWER CONVERSION ASSEMBLY
RADIATOR HEAT PIPES
DEPLOYED RADIATOR PANEL

- THERMOELECTRIC CONVERTER
  - IMPROVED EFFICIENCY
  - COMPACT/LOW WEIGHT (MINIATURIZE)
  - LOW COST
  - STABLE PERFORMANCE
- HEAT PIPES
  - LONG PIPES
  - LIFE TIME
- DEPLOYABLE RADIATOR
  - FLEXIBLE COUPLER

MAJOR RESULTS TO DATE
• INCREASED EFFICIENCY OF N-LEG 40% OVER STATE OF THE ART
• COMPLETED DESIGN OF COMPACT TE UNIT - FABRICATED SEVERAL COMPONENTS
• OPERATED 2- AND 4- METER PIPES

FIGURE 10

THERMIONIC CONCEPT

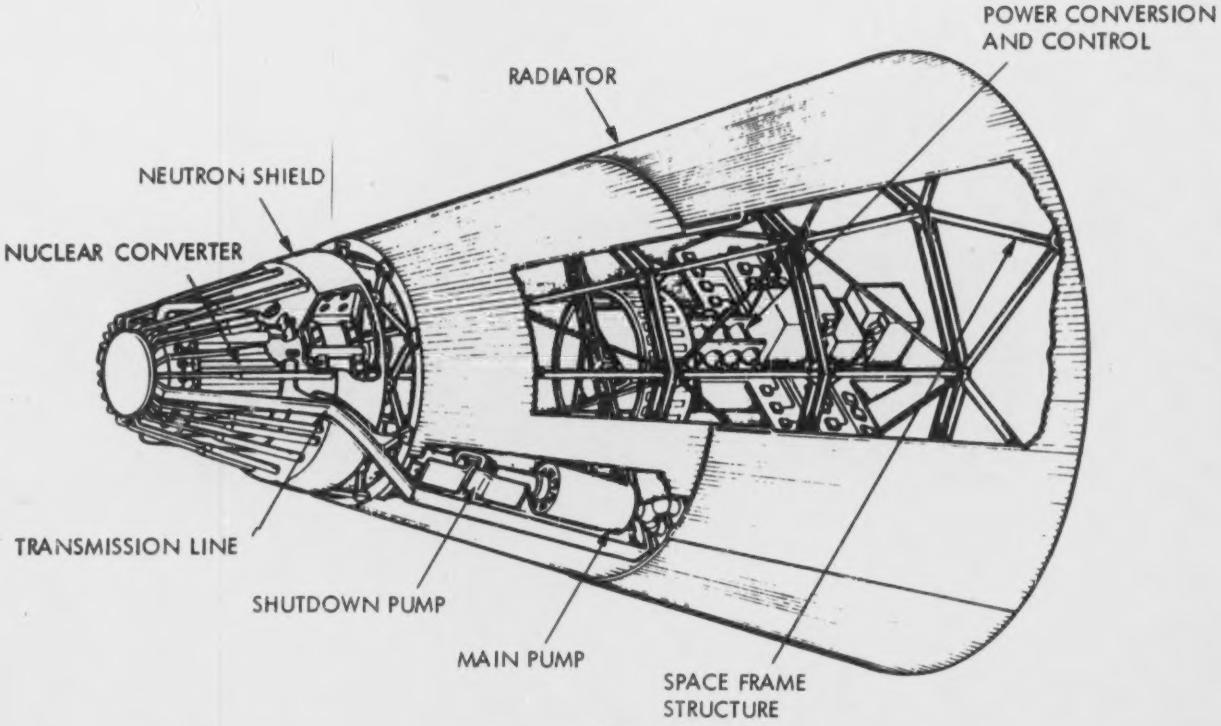
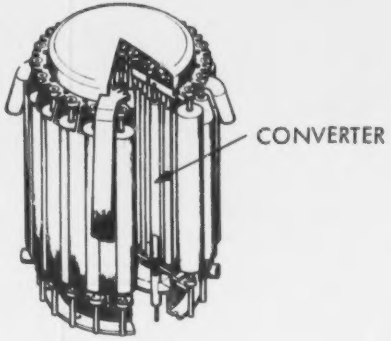
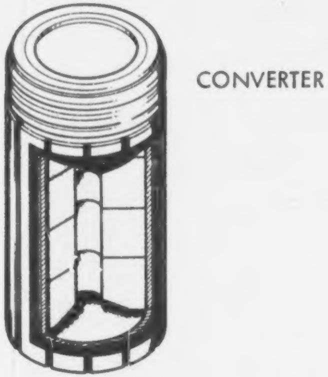

POWER CONVERSION AND CONTROL
RADIATOR
NEUTRON SHIELD
NUCLEAR CONVERTER
TRANSMISSION LINE
SHUTDOWN PUMP
MAIN PUMP
SPACE FRAME STRUCTURE

FIGURE 11

THERMIONIC FEASIBILITY ISSUES





- CONVERTER LIFETIME
  - FUEL SWELLING/EMITTER DISTORTION
  - CERAMIC INSULATORS
  - CERAMIC SEALS
- CONVERTER PERFORMANCE
  - HIGH EFFICENCY CONVERTERS

MAJOR RESULTS TO DATE

- REINSTATED CONVERTER FABRICATION TECHNOLOGY
- CONVERTERS IN REACTOR FOR TEST
- IDENTIFIED POTENTIAL CERAMIC INSULATORS-FABRICATED TEST UNITS

FIGURE 12

STIRLING CONCEPT

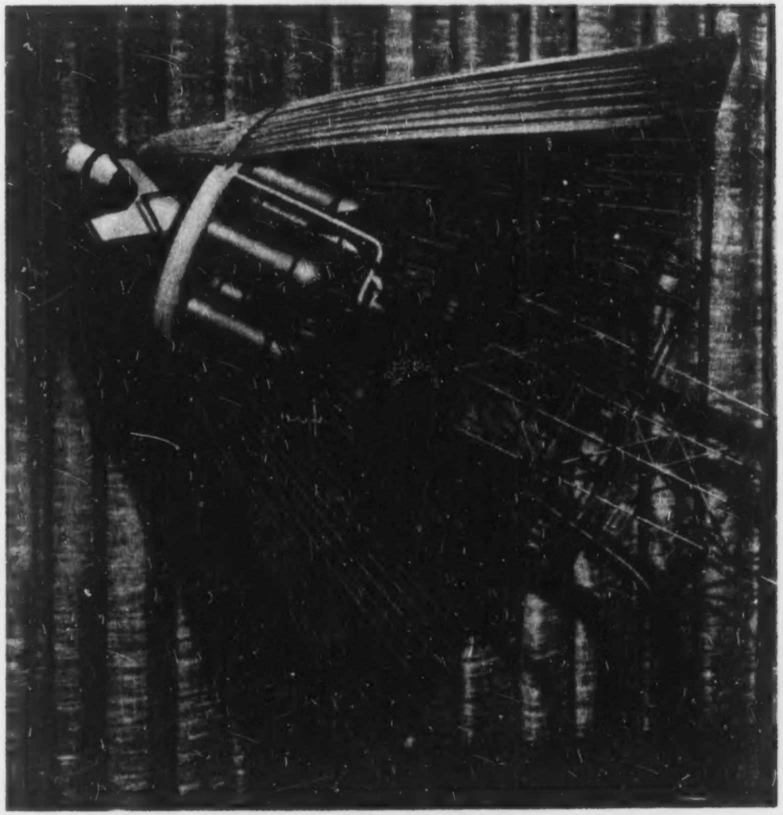
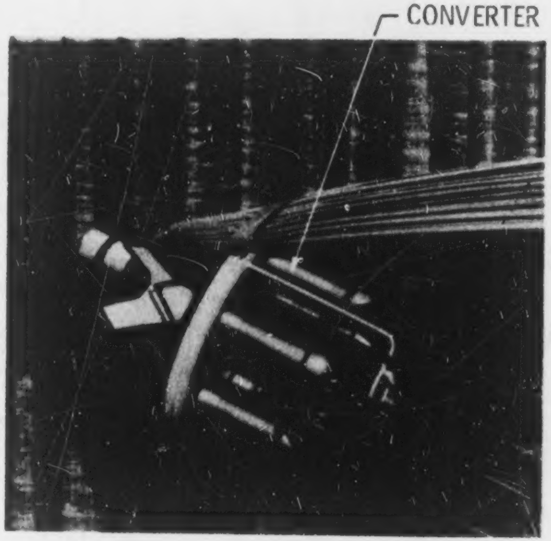


FIGURE 13

STIRLING FEASIBILITY ISSUES



- FREE PISTON STIRLING ENGINE
  - — SCALE UP (3 kWe → 25 kWe)
  - — THERMODYNAMIC EFFICIENCY ($T_h/T_c = 3 \rightarrow T_h/T_c = 2$)
  - — SELF-ACTUATING HYDROSTATIC BEARINGS
  - — DYNAMIC BALANCE
  - — LONG LIFE

MAJOR RESULTS TO DATE
• 25 kWe UNIT PARTIALLY FABRICATED • OVER 2500 HOURS OF TEST ON A 3 kWe UNIT • DYNAMIC BALANCE CONCEPT DEMONSTRATED

FIGURE 14

CONCLUDING REMARKS

- PROJECT IS ON TRACK
- EXTENSIVE EXPERIMENTAL RESULTS FROM SP-100 WILL SIGNIFICANTLY IMPROVE TECHNOLOGY BASE AND DECISION MAKING
- CONCEPT SELECTION TO BE ANNOUNCED IN THE AUGUST-SEPTEMBER 1985 TIME FRAME
- PHASE II REQUEST FOR PROPOSAL (RFP) TO INDUSTRY TO BE RELEASED IN OCTOBER 1985

FIGURE 15

Mr. **Stallings**. Thank you, Dr. Truscello. And we will without objection have your testimony included in the record.

Dr. Ambrus, you stated in your testimony that Mr. Beggs, the NASA Administrator, was briefed on December 20, 1984, on the SP-100 Program. What was his response to your recommendation to continue NASA support for the advancement of this technology?

Dr. **Ambrus**. Mr. Beggs concurred with our recommendation. However, he left the decision as to the level of the support up to the Office of Aeronautics and Space Technology.

Mr. **Stallings**. There are presently quite adequate procedures in place for approving the safety of the radioisotope generator for space flight. Wouldn't these same procedures be applicable to space reactors of the SP-100 type as well?

Dr. **Ambrus**. The safety procedures that are in place for the radioisotope thermoelectric generators is the Interagency Nuclear Safety Review Panel. And we are utilizing that process already. They have been briefed several times, and we are planning to use them.

However, we feel that additional safeguards will be necessary, and they will be addressed in a technical way.

Mr. **Stallings**. Dr. Truscello, I understand that Idaho is one of the contenders for siting the ground engineering test program for the next phase of the SP-100 program. I know that responsibility for site selection rests with the DOE, but I would be interested in your technical judgment about what must be done at the test site.

Mr. **Truscello**. Mr. Chairman, the test site must have the capability of basically testing just the reactor. Now, the reactor is a device that is not much larger, for a 100-kilowatt system, much larger than a wastepaper basket, if you will. It will not be very difficult to put together the necessary test facility vacuum chamber and so forth within a number of different possible facilities that the Government is presently considering.

Mr. **Stallings**. We do appreciate both of your testimonies. Again, we would like to submit some written questions to you for your consideration and would hope that you would respond, and we would include that in the record as well. We do thank you for your time and for your efforts in this behalf.

Dr. **Ambrus**. Thank you, Mr. Chairman.

Dr. **Truscello**. Thank you, Mr. Chairman.

Mr. **Stallings**. Dr. Knoll is our next witness.

STATEMENT OF DR. GLENN F. KNOLL, PROFESSOR AND CHAIRMAN, DEPARTMENT OF NUCLEAR ENGINEERING, THE UNIVERSITY OF MICHIGAN

Dr. **Knoll**. Mr. Stallings, members of the committee, due to the lateness of the hour I will try to keep my comments very brief. You do have a written statement that I would ask you to please enter in the record.

Mr. **Stallings**. Without objection.

Dr. **Knoll**. I am Glenn F. Knoll. I am professor and chairman of the Department of Nuclear Engineering at the University of Michigan, and I currently chair an organization of some 50 nuclear engineering departments in this country and Canada. And I am here to represent, I think, a vital ingredient in the nuclear program in this country that has not received notice this afternoon, and that is, the young people that must enter this field if we are to retain our vitality.

I invite you to make your own estimate of the average age of those of us who are appearing before you today and to guess the probability that in 20 years many of us will be back to share with you a debate over the fiscal year 2006 DOE budget. But I don't think very many of us will.

The young and vital ingredient that's necessary here is currently in our universities. And to put it very briefly, we are seeing a real erosion in the position of nuclear engineering departments in this country. It's not difficult to understand that. It comes from several sources, one of which is the perception widely held by the public that there is no future in the nuclear industry in this country.

I think we've heard today some of the exciting new things that are on the horizon that, given support here and from other sources, we can all expect to see, and certainly today and for the foreseeable future I think we see a strong job market for people in nuclear engineering. But we see also diminishing applications and I think a real concern for enrollment levels.

Now, what can we do about this? I think there are several things that this committee and the Department of Energy can help in terms of reversing this kind of trend. They lie in three general areas of research support, of graduate student fellowships, and support for university research reactors.

To begin with, in the research area, you should realize that research that is channeled to university departments by and large goes toward two general purposes, one of which is to purchase equipment which enhances the teaching program at universities and the other is to support graduate student assistants in pursuit of their graduate degrees. And I would argue that the expenditure of funds in this way has real leverage in the sense that not only does one achieve research objectives, but one also is encouraging the participation of young people in the field, which leads them to the education of scientists and engineers, which we will all agree are important to our Nation's future.

I think it is fair to say that at least in the fast reactor area, less than 1 percent of the DOE budget currently is allocated to universities, and I don't think the figures are very much larger in any of the reactor-related activities of DOE. And this, of course, is vital to the interests of the nuclear engineering departments. It is true that many of the departments can in fact find the research support in areas outside of reactors, and we're seeing more and more nuclear engineering departments branch out into areas of science, of physics, in even chemical processing, because one can find support there.

Where it is very difficult to find support, as a matter of fact, is in reactor engineering in the traditional mainline activities of nuclear engineering departments. It is here that I would encourage this committee and the Department of Energy to look very closely at the share of the research support that, currently being a very small number, is allocated to universities.

In the area of graduate fellowships, there is a DOE-sponsored graduate fellowship program that is certainly laudable and serves a very useful purpose. I will only point out that over the past year the mainline support in this area to nuclear science and engineering has been reduced significantly because of funding limitations.

And finally, I will point up the associated problem of the operation of research reactors on campus. Any strong nuclear engineering department must have access to a research reactor for teaching and research purposes. There are some 49 such research reactors around the country. They involve rather sizable operation budgets that, in some cases, are supported by the host university when these are small, low-power reactors, but more often support outside the campus must be found in order to maintain these facilities.

Again, the subject of research enters here. One of the sources of such support is, in fact, use charges to sponsored research accounts.

But a related matter is the likelihood that the Nuclear Regulatory Commission will soon require the substitution of low-enrichment fuel for high-enrichment uranium in these reactors. There is, to my knowledge, no current source of funding earmarked to cover the cost of this conversion. It is almost certain that in the absence of supplementary support from the Federal Government, many universities will choose simply to shut down these facilities rather than incur the substantial cost of conversion entirely on their own.

If a sizable fraction of the campus reactors are lost through this step, the effect on nuclear engineering education in this country would be devastating.

I therefore urge that this committee and the Department of Energy look closely into this problem and take whatever steps are necessary to provide some funding assistance in the event that the NRC imposes this requirement as a condition for future operation.

I thank you for your time and attention.

[The prepared statement of Dr. Knoll follows:]

Testimony to

Subcommittee on Energy Research and Production

Committee on Science and Technology

U.S. House of Representatives

by
Glenn F. Knoll
Professor and Chairman
Department of Nuclear Engineering
The University of Michigan

February 21, 1985

My name is Glenn F. Knoll. I am Professor and Chairman of the Department of Nuclear Engineering at The University of Michigan. I am testifying today as Chairman of the Nuclear Engineering Department Heads Organization, a group that represents over 50 nuclear engineering departments and programs throughout the United States and Canada. My testimony will be primarily concerned with the current status and problems facing nuclear engineering programs in this country, and ways in which this Committee and the Department of Energy can help in resolving these problems.

Nuclear Engineering is broadly defined as encompassing those engineering activities related to the application of nuclear energy, nuclear radiation, or other basic nuclear processes. The discipline was born in the mid-1950s in response to intense governmental and industrial interest in the peaceful exploitation of energy from the atom.

In the three decades that have followed, most programs have gone through a period of expansion and growth extending to about the mid-1970s. Since that time, virtually every nuclear engineering program has shown a decline in enrollment ranging typically from 10% to 30%. This decline has coincided with the period in which the U.S. nuclear power industry has undergone its well publicized problems. This decrease in enrollment, coming during a period in which engineering enrollments in general have been rising, has left most nuclear engineering programs in a weakened position when competing for limited university resources. Over the past several years, a significant number of nuclear engineering departments have either been eliminated or combined with more traditional departments in the interest of economy.

One might conclude that, based on all the negative headlines, such a retrenchment is entirely appropriate. However, I shall argue that this weakening in our capacity to educate young people in nuclear engineering in this country should be of concern not only to us in the educational community, but also to those of you in government who may be in a position to help reverse the situation.

Current graduates in nuclear engineering are finding ample opportunities for employment in both industry and government laboratories. Typical positions at the undergraduate level are with electric utility companies, reactor vendors, architect engineers, and radiation-related industries. For holders of advanced degrees, additional possibilities are found in industrial research, nuclear medicine, and national defense. In each of these areas, the special background and skills of nuclear engineers play a very important role.

The need for nuclear engineers is likely to grow in the future. A recently completed survey[1] carried out to predict the manpower needs in the nuclear power industry has concluded that, even under the most pessimistic predictions on future growth of nuclear power in this country, nuclear engineers will continue to be needed at about the current graduation rate for the foreseeable future. If, as many of us believe, new reactor starts will be required in the 1990s, then a sizeable shortfall in the supply of nuclear engineers in this industry is predicted.

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[1] W. Stevenson, "Personnel Requirements, Education, and Training for Civilian Nuclear Activities, 1984-2000", ORAU-231 (1984).

The electric power industry is not the only enterprise in which nuclear engineers are needed. Many related industries require similar expertise. For example, the use of radiation in medicine or for food preservation will continue to require engineers with nuclear backgrounds. Government defense laboratories and defense industries must also have a supply of technical personnel with similar expertise. All indications are that many of our important high tech industries will require a larger supply of engineers with nuclear training in the future. Within the Department of Energy, the potential shortage of nuclear engineers at the Ph.D. level has already been recognized through the issuance of a "manpower alert" on this topic within the past year.

There are several ways in which this Committee and the Department of Energy can assist nuclear engineering programs in maintaining their strength and reversing the enrollment trends of the last few years. These steps involve the issues of research support, graduate student fellowships, and support for university research reactors. In each of these areas, university programs can be greatly strengthened through relatively modest changes in support levels and/or Departmental policies.

In the research area, many nuclear engineering programs are currently participating in DOE-funded research through a number of Departmental divisions. Much of this support is used to provide Research Assistant stipends to graduate students pursuing advanced degrees in nuclear engineering. It also is a means of providing special laboratory equipment that can greatly enhance the teaching program of the university. In competing for such awards, universities are sometimes disadvantaged by the programmatic emphasis traditionally placed in some development activities. For example, I believe that less than 1% of all DOE expenditures in the area of fast reactor development are made in contracts to universities. A greater emphasis on innovation and new approaches could lead to a greater university participation and create an atmosphere in which nontraditional thinking is encouraged. Research expenditures at universities also pay a dividend in the education of scientists and engineers important to our nation's future.

Graduate student fellowships are another means of encouraging enrollment in nuclear engineering programs. The Department of Energy currently supports a modest fellowship program that includes specialities in nuclear engineering, health physics, radioactive waste management, and fusion technology. Experience has shown that the quality of students awarded these fellowships has been outstanding, and this support has served as a very welcome means for some of the best engineering graduates to pursue advanced degrees in the nuclear area. Nonetheless, the number of new fellowships in nuclear science and engineering has recently been curtailed because of funding reductions.

There are a total of 49 research reactors currently in operation on U.S. campuses. Virtually all nuclear engineering program depend on the availability of a research reactor to support vital teaching and research activities. Operating costs for these reactors vary over a wide range depending on their power and number of operating shifts. Annual costs range from less $50,000 a year for low power facilities to as large as a $1,000,000 for the largest campus reactors. Most universities provide a significant fraction of these operating costs, but many of them could not continue operation without outside funding. Such support is often found from local industry, utility training programs, or user fees from sponsored research contracts. The Department of Energy has also provided support for some of these reactors through assistance in fuel procurement and through the reactor use-sharing program, in which other colleges and universities are encouraged to make use of a nearby reactor facility. These programs are relatively modest, and small dollar increases could have large effects on the utilization of these valuable research facilities. For example, the reactor sharing program is funded at a total annual level of $200,000 for all facilities across the country. Increasing this level of support would certainly allow a more efficient use of these valuable facilities not only by the host university, but also by smaller colleges and universities across the country.

A related matter is the likelihood that the Nuclear Regulatory Commission will soon require the substitution of low enrichment fuel for high enrichment uranium in all U.S. research reactors. This conversion step would be a very costly one for many facilities. There is, to my knowledge, no current source of funding earmarked to cover the cost of this conversion. It is almost certain that, in the absence of supplementary support from the Federal government, many universities will choose simply to shut down these facilities rather than incur the substantial cost of the conversion entirely on their own. If a sizeable fraction of the campus reactors are lost through this step, the effect on nuclear engineering education in this country would be devastating. I therefore urge that this Committee and the Department of Energy look closely into this problem, and take whatever steps are necessary to provide funding assistance in the event that the NRC imposes this requirement as a condition for future operation.

Thank you very much for your time and attention.

Mr. STALLINGS. Thank you.

Let me ask you a couple of questions. Who are some of the 50 universities represented by your organization of department heads?

Dr. KNOLL. Well, I think you could pretty much run a roster of all the major public universities across the country, including, say, virtually all the Big Ten universities, certainly the University of California, MIT. It's really a list of the major universities in this country.

Mr. STALLINGS. Is there room in this program for the small universities like the Idaho State University in my district?

Dr. KNOLL. Well, certainly, and Idaho State is a member, in fact, of NEDHO, the organization that I represent.

Mr. STALLINGS. That's very interesting.

Several innovative ideas and initiatives are being explored by the department for the nuclear fission in the R&D area. Is any attempt being made to involve the universities in these activities, and could you comment on the broad-based capability of the nuclear engineering departments not only to do research but also policy analysis?

Dr. KNOLL. Well, the first topic, innovative research, innovative reactor designs certainly are of great interest to nuclear engineering departments. And in fact, there are programs, small ones, currently underway at several universities; for example, the involvement of MIT in the PIUS program. Speaking now for the University of Michigan, we also are involved to a small degree in some IFR-related activities.

I think questions of planning and policy are better left to people outside strictly nuclear engineering departments, although I am sure we can play some role in this field. I do not think it is a strength of nuclear engineering departments, certainly not a traditional strength. And I would like to see us, in fact, concentrate on those things we do best, which is, in fact, engineering.

Mr. STALLINGS. Well, I have been very concerned about this. In Idaho Falls we have one of the finest scientific communities in the world, and 48 miles south, a university that does not make a lot of use of that facility or that braintrust. I would hope that we could do some things by this committee and with your organization.

Dr. KNOLL. Certainly. I am very appreciative of the Idaho facility, as I have just come off a 6-year term on the EBR-2 review committee. So I do very much appreciate the elegant facilities and the very fine engineering that has gone on at Idaho.

Mr. STALLINGS. I would certainly like to see young people involved in that program to a greater degree.

I will apologize on behalf of the committee to you for the light turnout and this late hour, but we want you to feel very comfortable that you have a lot of support on this committee for the kinds of things that you're doing. We would hope that we would be able to work very closely with you and bring more people, particularly younger people, into this particular program.

We do again thank you for your time and your testimony, and we want you to feel assured that it will be considered and put into the record and our people will be made aware of it.

The subcommittee will meet again next Tuesday, February 26, at 1 p.m., in room 2318, Rayburn, to hear from the Department of the Nuclear Waste Management.

Until then, this committee stands adjourned.

[Whereupon, at 6:06 p.m., the committee was adjourned, to reconvene at 1 p.m., Tuesday, February 26, 1985.]

1986 DEPARTMENT OF ENERGY AUTHORIZATION

TUESDAY, FEBRUARY 26, 1985

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION,
Washington, DC.

The subcommittee met, pursuant to notice, at 1 p.m., in room 2318, Rayburn House Office Building, Hon. Marilyn Lloyd (chairman of the subcommittee) presiding.

Present: Representatives Lloyd, Roe, Lundine, Morrison, and Monson.

Staff present: John V. Dugan, staff director; Louis Ventre, counsel; Tim Peckinpaugh, Republican technical consultant; and Debby Johnson, subcommittee clerk.

Mrs. LLOYD. Good afternoon, ladies and gentlemen. The Subcommittee on Energy Research and Production will come to order.

Today we will be receiving testimony from the Department of Energy and their proposed budgets in Nuclear Waste Management. This includes programs dealing with the Nuclear Waste Fund, the Civilian Research and Development Program, the Waste Technology Program, and the Remedial Action Program. The total budget authority for these Nuclear Waste Management Programs amounts to approximately $840 million, of which about $575 million is for the Waste Fund Disposal Program and is recovered from the private sector through a surcharge on electricity produced from nuclear powerplants.

Concerning the Nuclear Waste Fund Program, the committee has three principal areas of concern which will be explored during the hearings. These involve the schedule at which DOE is completing its activity under the Waste Act, the need for a MRS facility, and the adequacy of the Department's management activities concerning the mission plan and the project decision schedule.

In the Nuclear Waste Technology Program, the committee will explore whether funds ought to be set aside for continuing work on new waste forms, an effort which has not received the utmost attention from the Department of Energy.

In the Remedial Action Program, the subcommittee is concerned that the Uranium Mill Tailings Program is growing to such a level that it is significantly competing for funds that might otherwise be available for research and development. The committee must consider a recommendation that the program be extended beyond the 7-year completion time stipulated in the Uranium Mill Tailings

Act. Additionally, the subcommittee will review the various New York State contributions to the West Valley Demonstration Project.

Before I introduce the first Department of Energy witness, I would like to ask the subcommittee's ranking Republican member, Mr. Morrison, if he would like to deliver any opening remarks.

Mr. Morrison?

[The prepared opening statement of Mrs. Lloyd follows:]

OPENING STATEMENT
CHAIRMAN LLOYD
HEARING ON NUCLEAR WASTE MANAGEMENT
FEBRUARY 26, 1985

GOOD AFTERNOON, LADIES AND GENTLEMEN. TODAY WE WILL BE RECEIVING TESTIMONY FROM THE DEPARTMENT OF ENERGY ON THEIR PROPOSED BUDGETS IN NUCLEAR WASTE MANAGEMENT. THIS INCLUDES PROGRAMS DEALING WITH THE NUCLEAR WASTE FUND, THE CIVILIAN RESEARCH AND DEVELOPMENT PROGRAM, THE WASTE TECHNOLOGY PROGRAM, AND THE REMEDIAL ACTION PROGRAM. THE TOTAL BUDGET AUTHORIZATION FOR THESE NUCLEAR WASTE MANAGEMENT PROGRAMS AMOUNTS TO APPROXIMATELY $840 MILLION, OF WHICH ABOUT $575 MILLION IS FOR THE WASTE FUND DISPOSAL PROGRAM AND IS RECOVERED FROM THE PRIVATE SECTOR THROUGH A SURCHARGE ON ELECTRICITY PRODUCED FROM NUCLEAR POWERPLANTS.

CONCERNING THE NUCLEAR WASTE FUND PROGRAM, THE COMMITTEE HAS THREE PRINCIPAL AREAS OF CONCERN WHICH WILL BE EXPLORED DURING THE HEARING. THESE INVOLVE THE SCHEDULE AT WHICH DOE IS COMPLETING ITS ACTIVITY UNDER THE WASTE ACT, THE NEED FOR AN MRS FACILITY, AND THE ADEQUACY OF THE DEPARTMENT'S MANAGEMENT ACTIVITIES CONCERNING THE MISSION PLAN AND PROJECT DECISION SCHEDULE.

IN THE NUCLEAR WASTE TECHNOLOGY PROGRAM, THE COMMITTEE WILL EXPLORE WHETHER FUNDS OUGHT TO BE SET ASIDE FOR CONTINUING WORK ON NEW WASTE FORMS, AN EFFORT WHICH HAS APPARENTLY BEEN ALL BUT ABANDONED BY THE DEPARTMENT OF ENERGY.

IN THE REMEDIAL ACTION PROGRAM, THE SUBCOMMITTEE IS CONCERNED THAT THE URANIUM MILL TAILINGS PROGRAM IS GROWING TO SUCH A LEVEL THAT IT IS

SIGNIFICANTLY COMPETING FOR FUNDS WHICH MIGHT OTHERWISE BE AVAILABLE FOR RESEARCH AND DEVELOPMENT. THE COMMITTEE MUST CONSIDER A RECOMMENDATION THAT THE PROGRAM BE EXTENDED BEYOND THE SEVEN-YEAR COMPLETION TIME STIPULATED IN THE URANIUM MILL TAILINGS ACT. ADDITIONALLY, THE SUBCOMMITTEE WILL REVIEW THE VARIOUS NEW YORK STATE CONTRIBUTIONS TO THE WEST VALLEY DEMONSTRATION PROJECT.

BEFORE I INTRODUCE THE FIRST DEPARTMENT OF ENERGY WITNESS, I WOULD LIKE TO ASK THE SUBCOMMITTEE'S RANKING REPUBLICAN MEMBER, MR. MORRISON, IF HE WOULD LIKE TO DELIVER ANY OPENING REMARKS.

AT THIS TIME, I WOULD LIKE TO INTRODUCE OUR FIRST DEPARTMENT OF ENERGY WITNESS, MR. JAMES VAUGHAN, THE ACTING ASSITANT SECRETARY FOR NUCLEAR ENERGY, WHO WILL BE DISCUSSING THE NUCLEAR WASTE TECHNOLOGY PROGRAM, THE REMEDIAL ACTION PROGRAM AND THE CIVILIAN RADIOACTIVE WASTE RESEARCH AND DEVELOPMENT PROGRAM. JIM, IT IS GOOD TO HAVE YOU HERE WITH US AGAIN TODAY. WE HAVE YOUR STATEMENT BEFORE US AND IT WILL BE INCLUDED IN ITS ENTIRETY IN THE RECORD. YOU MAY SUMMARIZE IT OR PROCEED AS YOU WISH.

OUR NEXT WITNESS IS BEN RUSCHE, THE DIRECTOR OF THE OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT. WE WELCOME YOU BACK BEFORE THE SUBCOMMITTEE, BEN. MR. RUSCHE WILL BE DESCRIBING THE DEPARTMENT'S NUCLEAR WASTE FUND ACTIVITIES WHICH ARE, BY ANY RECKONING, THE SUBJECT OF A GREAT DEAL OF DISCUSSION. BEN HAS A DIFFICULT JOB BALANCING THE COMPETING INTERESTS AND REMAINING IN COMPLIANCE WITH THE NUCLEAR WASTE POLICY ACT. WE HAVE A FEW DISAGREEMENTS WITH HIS OFFICE'S APPROACH TO IMPLEMENTATION, BUT WE HOPE TO RECONCILE THEM DURING THIS BUDGET PROCESS. BEN, WE HAVE YOUR WRITTEN TESTIMONY BEFORE US. IT WILL BE INCLUDED IN THE RECORD IN ITS ENTIRETY. YOU MAY SUMMARIZE OR PROCEED AS YOU WISH.

Mr. Morrison. Thank you, Madam Chairman.

As the Chairman has already stated, today the subcommittee begins our review of the Department of Energy budget for civilian nuclear waste activities. These programs are critical to the overall effort to safely store, handle, transport, and eventually dispose of high-level and low-level nuclear waste. I'm pleased that Jim Vaughan is back for his second appearance and that Ben Rusche has joined him. I look forward to working with both of you as the site selection process for the two high-level nuclear waste repositories unfolds.

My congressional district is no stranger to the management of nuclear waste. The Hanford site already takes over half of the country's commercial low-level waste. We have about half of the Nation's Defense waste already in storage, and we've been identified by DOE in a draft environmental assessment as one of three candidate sites for a high-level nuclear waste repository. Up to this point, Hanford has been a willing partner in working with the Federal Government to manage the Nation's nuclear waste.

This hearing gives us an opportunity to continue this working relationship. The residents of Washington State have several legitimate concerns about siting a repository at Hanford, particularly ground water contamination and transportation. Unlike other candidate sites, Washington State has worked well in the spirit of cooperation with the Department during the site selection process. Despite the generally good rapport cultivated between the State and DOE, a couple of problems persist which I hope to address today.

The first is Federal liability. The State feels strongly, and I tend to agree, that the Federal Government must maintain absolute and strict liability for any contamination that might result from a nuclear waste repository. I fully understand that DOE is in a legal box; but I sincerely hope that DOE can work earnestly with the State to reach an accord on this liability issue. We in Congress are also considering legislation, including revision of the Price/Anderson Act, to remedy this particular matter.

The second concern is State comment. Washington State and the Yakima Indian Tribe have urged DOE to extend the deadline for comment on the environmental assessments for an additional 60 days. I understand the need to adhere to deadlines and the specific timetable outlined in the act; however, State participation and comment is critical to the overall success of site selection process. While deadlines are important, the interests of the States and affected tribes must come first. A hallmark of the act was complete and open public involvement, and I hope that we can work together to fulfill this objective.

Madam Chairman, again, thank you for your courtesies and I hope to address these two particular matters and others today in a very constructive fashion.

[The prepared opening statement of Mr. Morrison follows:]

OPENING STATEMENT OF THE HONORABLE SID MORRISON ON THE FY 1986 DOE AUTHORIZATION REQUEST FOR NUCLEAR WASTE MANAGEMENT

SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION
FEBRUARY 26, 1985

GOOD AFTERNOON. AS THE CHAIRMAN HAS ALREADY STATED, TODAY THE SUBCOMMITTEE BEGINS OUR REVIEW OF THE DOE BUDGET FOR CIVILIAN NUCLEAR WASTE ACTIVITIES. THESE PROGRAMS ARE CRITICAL TO THE OVERALL EFFORT TO SAFELY STORE, HANDLE, TRANSPORT, AND EVENTUALLY DISPOSE OF HIGH-LEVEL AND LOW-LEVEL NUCLEAR WASTE. I'M PLEASED THAT JIM VAUGHAN IS BACK FOR HIS SECOND APPEARANCE AND THAT BEN RUSCHE HAS JOINED HIM. I LOOK FORWARD TO WORKING WITH BOTH OF YOU AS THE SITE SELECTION PROCESS FOR THE TWO HIGH-LEVEL NUCLEAR WASTE REPOSITORIES UNFOLDS.

MY CONGRESSIONAL DISTRICT IS NO STRANGER TO THE MANAGEMENT OF NUCLEAR WASTE. THE HANFORD SITE ALREADY TAKES OVER HALF OF THE COUNTRY'S COMMERCIAL LOW-LEVEL WASTE, WE HAVE ABOUT HALF OF THE NATION'S DEFENSE WASTE ALREADY IN STORAGE, AND WE HAVE BEEN INDENTIFIED BY DOE IN A DRAFT ENVIRONMENTAL ASSESSMENT AS ONE OF THREE CANDIDATE SITES FOR A HIGH-LEVEL NUCLEAR WASTE REPOSITORY. UP TO THIS POINT, HANFORD HAS BEEN A WILLING PARTNER IN WORKING WITH THE FEDERAL GOVERNMENT TO MANAGE THE NATION'S NUCLEAR WASTE.

THIS HEARING GIVES US AN OPPORTUNITY TO CONTINUE THIS WORKING RELATIONSHIP. THE RESIDENTS OF WASHINGTON STATE HAVE SEVERAL LEGITIMATE CONCERNS ABOUT SITING A REPOSITORY AT HANFORD, PARTICULARLY GROUNDWATER CONTAMINATION AND TRANSPORTATION. UNLIKE OTHER CANDIDATE SITES, WASHINGTON STATE HAS WORKED WELL IN THE SPIRIT OF COOPERATION

WITH THE DEPARTMENT DURING THE SITE SELECTION PROCESS. DESPITE THE GENERALLY GOOD RAPPORT CULTIVATED BETWEEN THE STATE AND DOE, A COUPLE OF PROBLEMS PERSIST WHICH I HOPE TO ADDRESS TODAY.

THE FIRST IS FEDERAL LIABILITY. THE STATE FEELS STRONGLY, AND I TEND TO AGREE, THAT THE FEDERAL GOVERNMENT MUST MAINTAIN ABSOLUTE AND STRICT LIABILITY FOR ANY CONTAMINATION THAT MIGHT RESULT FROM A NUCLEAR WASTE REPOSITORY. I FULLY UNDERSTAND THAT DOE IS IN A LEGAL BOX. BUT I SINCERELY HOPE THAT DOE CAN WORK EARNESTLY WITH THE STATE TO REACH AN ACCORD ON THIS LIABILITY ISSUE. WE IN CONGRESS ARE ALSO CONSIDERING LEGISLATION, INCLUDING REVISION OF THE PRICE/ANDERSON ACT TO REMEDY THIS MATTER.

THE SECOND CONCERN IS STATE COMMENT. WASHINGTON STATE AND THE YAKIMA INDIAN TRIBE HAVE URGED DOE TO EXTEND THE DEADLINE FOR COMMENT ON THE ENVIRONMENTAL ASSESSMENTS FOR ADDITIONAL 60 DAYS. I UNDERSTAND THE NEED TO ADHERE TO DEADLINES AND THE SPECIFIC TIMETABLE OUTLINED IN THE ACT. HOWEVER, STATE PARTICIPATION AND COMMENT IS CRITICAL TO THE OVERALL SUCCESS OF SITE SELECTION PROCESS. WHILE DEADLINES ARE IMPORTANT, THE INTERESTS OF THE STATES AND INDIAN TRIBES MUST COME FIRST. A HALLMARK OF THE ACT WAS COMPLETE AND OPEN PUBLIC INVOLVEMENT AND I HOPE THAT WE CAN WORK TOGETHER TO FULFILL THIS OBJECTIVE.

MADAM CHAIRMAN, I HOPE TO ADDRESS THESE TWO MATTERS AND OTHERS TODAY IN A CONSTRUCTIVE FASHION. WASHINGTON STATE IS WILLING TO WORK CLOSELY WITH THE FEDERAL GOVERNMENT, BUT DOE NEEDS TO BE MORE SENSITIVE TO SPECIFIC CONCERNS OF THE EFFECTED STATES AND TRIBES.

Mrs. LLOYD. Thank you very much, Mr. Morrison. I thought I saw former Member of Congress Mike McCormack; he probably just came in—but it was good to see Mike McCormack again in this room, even if only for a very brief time.

I'd like to recognize Congressman Roe at this time for any opening remarks you may have.

Mr. ROE. I don't really have any substantive opening remarks, Madam Chairman. I just want to welcome our witnesses again before our distinguished committee and compliment you for the great work you are doing as chairman of this committee.

Mrs. LLOYD. Thank you very much, and we certainly appreciate your contributions to the committee. You are one of our tried and true and loyal and faithful members who is very valuable to this committee. And I will make those remarks in your district next year, if you would like. [Laughter.]

At this time, I would like to introduce our first Department of Energy witness, Mr. James Vaughan, who is Acting Assistant Secretary for Nuclear Energy, who will be discussing the Nuclear Waste Technology Program, the Remedial Action Program, and the Civilian Radioactive Waste Research and Development Program.

It is good to have you here today, and we have your statement before us and you can proceed in any way that you see fit, and your entire statement will be made a part of the record.

STATEMENTS OF JAMES W. VAUGHAN, JR., ACTING ASSISTANT SECRETARY FOR NUCLEAR ENERGY, U.S. DEPARTMENT OF ENERGY, ACCOMPANIED BY WILLIAM R. VOIGT, ACTING DIRECTOR, OFFICE OF TERMINAL WASTE DISPOSAL AND REMEDIAL ACTION, U.S. DEPARTMENT OF ENERGY, AND JACK BAUBLITZ, DIRECTOR OF REMEDIAL ACTION PROGRAMS, U.S. DEPARTMENT OF ENERGY

Mr. VAUGHAN. Thank you very much, Madam Chairman, and members of the subcommittee. I am pleased to be here again today, this time to discuss the Department of Energy's Nuclear Waste Technology and Remedial Action Programs.

Although the Remedial Action Programs are not specifically or primarily research and development oriented, they have always been of interest to this committee. As you know from the budget tables, our Nuclear Waste Technology funding request for fiscal year 1986 is $11.7 million in budget authority, as compared to a $13 million level in fiscal year 1985. Our fiscal year 1986 budget request for Remedial Action Programs is $233 million, up $73 million over our 1985 appropriation.

Before providing a brief overview of these programs, I do want to assure you that the Department takes very, very seriously its responsibilities to perform remedial actions to clean up the environment within the several programs that are by this appropriation. We have established appropriate priorities for these programs on the basis of contamination levels and the proximity of public activities, and we are proceeding at a reasonable and technically acceptable pace to accomplish these goals.

At the same time, we are continuing our monitoring and surveillance activities at each of the sites to assure that none of them will create a health or safety hazard for people in surrounding areas.

Fiscal year 1984 and 1985 activities in a number of these projects have been characterized by overall program planning, engineering preparation, and establishing cooperative agreements with the States, Indian tribes, municipalities, and industrial concerns involved at the various sites. In addition, work has actually begun at a number of the highest priority sites. In order to maintain the schedule for this work we do anticipate the need for higher funding levels in the next 2 years as we move from the planning and engineering stages to the actual performance of work at additional sites.

Because of the Department's strong commitment to completing these cleanup efforts, we have elected in balancing our budget priorities to continue these programs at levels only slightly below previous outyear funding projections rather than maintaining them at fiscal year 1985 funding levels. This was a tough choice, but to have chosen the latter course—that is, level funding—we felt would have entailed unnecessary delays in completing many of the projects with resulting increases in total costs to the Government over the period of work.

I would now like to provide a brief overview of these programs.

The funds in the Nuclear Waste Technology category are distributed among the program elements shown on page 3 of the statement which we have submitted. As I think most of you know, the role of our Nuclear Waste Technology Program is to assist the States and regions in developing a reliable national system for managing commercial low-level wastes, to develop technologies that will safely and effectively treat and immobilize nuclear fuel cycle waste, both low-level, high-level, and transuranic. In 1980, legislation was enacted assigning States the responsibility for disposal of low-level nuclear wastes. And so our Low-Level Waste Program continues to provide technical assistance to these States, and it has been useful in getting proposed regional compacts presented to the Congress for consent. As you may be aware, we have very recently responded to a series of questions that Congressman Udall asked regarding the criteria to be used to evaluate these proposed regional compacts, and we will be providing a copy of that report to this committee and other interested committees this week.

[Material to be supplied follows:]

DOE/NE-0058

Considerations for Evaluating Proposed Low-Level Radioactive Waste Compacts

Prepared for:
Congressman Morris K. Udall, Chairman
Committee on Interior and Insular Affairs
U.S. House of Representatives

U.S. Department of Energy
Assistant Secretary for Nuclear Energy

FEBRUARY 1985

EXECUTIVE SUMMARY

The Low-Level Radioactive Waste Policy Act that became law in December 1980 (Public Law 96-573) set forth as the policy of the Federal Government that each State is responsible for providing for the availability of capacity either within or outside the State for the disposal of low-level radioactive waste generated within its borders except for wastes generated by certain activities of the Secretary of Energy or federal research and development activities. Further, the law affirmed the policy that low-level radioactive waste can be most safely and efficiently managed on a regional basis. When a proposed regional compact has been negotiated, it may not take full effect until the Congress has consented to the compact. After January 1, 1986, any such ratified compact may restrict the use of regional disposal facilities under the compact to the disposal of low-level radioactive waste generated within the region.

Thirty-nine States have enacted legislation related to this Act, and five compacts have been submitted to Congress for consent. Other compacts are being negotiated, one in the West and several in the Midwest and Northeast.

The U.S. House of Representatives Committee on Interior and Insular Affairs is one of several congressional committees that are reviewing and evaluating these proposed compacts. To assist in this review, the U.S. Department of Energy has prepared this report in response to two questions asked by Congressman Morris K. Udall, Chairman of the House Committee on Interior and Insular Affairs (Appendix A). The questions are:

provide a common focus that may be useful to the Congress in integrating all available information.

The Department believes that the Congress should consider the following key items when reviewing the compacts:

- Commitments that assure the provision of new disposal capacity in the form of a host-State and site selection process with schedules and a target date for new sites to be opened.
- Commitments that provide short-term measures for storage, treatment, or disposal during an interim period when such new capacity may not be available.
- Consistency of definitions with 10 CFR Part 61 to assure the compact plan presents a total solution for all low-level waste generated within the region.
- Periodic review of the compacts by the Congress to examine concerns that are more easily assessed after a compact becomes operational, e.g., economic viability and long-term institutional control.
- Economic viability of a compact, when reviewed in the future, in terms of the benefits and the costs specific to that region.

(The full text of the report is on file in the subcommittee offices.)

Mr. VAUGHAN. Within our Waste Treatment Program, we conduct the research and development necessary to reliably solidify high-level and transuranic wastes for transportation, storage, or disposal. Our major fiscal year 1986 effort in waste treatment will be to complete the last phase of development of the process for incorporating high-level waste into a borosilicate glass form acceptable for disposal. In November 1984, the Department entered into a collaborative research and development project agreement with the Federal Republic of Germany on process controls and operation of a facility for solidification of high-level radioactive waste. Our side of this effort is to utilize the radioactive liquid-fed ceramic melter at the Pacific Northwest Laboratory in the Richland area, to be operated over a period of several months in fiscal years 1985 and 1986. We plan to fabricate at least 10 and as many as 30 canisters of radioactive borosilicate glass in that facility for subsequent use by the Federal Republic of Germany for testing purposes in their waste management program.

I might just say, as an aside, it was my real pleasure last month to participate with Congressman Morrison in the dedication of that facility, and it is a unique and special facility within this country.

In the area of remedial action programs, the funds that we have requested among the various program elements are distributed according to the table shown on page 5 of our statement for the record.

As indicated in that table, our program for remedial action at these contaminated facilities and sites is divided into 5 major activities, 2 of which are being conducted pursuant to the Department's responsibilities under the Atomic Energy Act, as amended, and 3 in accordance with separate public laws.

First, the Formerly Utilized Sites Remedial Action Project—and I hope you will allow me to say FUSRAP, since that's become a familiar term—does cover former non-Government nuclear processing sites that require stabilization or removal of contaminated material. We currently have the authority to conduct these remedial actions at 25 sites, and in fiscal year 1986 our actions will focus on continuation of ongoing efforts at the highest priority sites, which are those located near Niagara Falls, NY; toward Wayne, NJ, which is in Congressman Roe's District; Middlesex, NJ; Maywood, NJ; Colonie, NY and Hazlewood, MO.

Now, the second project under this category covers our participation in a Federal-State cooperative effort which was mandated by a public law to remove uranium mill tailings which had been used for construction purposes in the area of Grand Junction, CO. By the end of fiscal year 1986 we will have completed remedial actions at 576 of the approximately 604 structures requiring attention, and completion of the remainder of this effort will occur in fiscal year 1987.

Under the Uranium Mill Tailings Remedial Action Project, usually called UMTRAP, we have work directed toward the cleanup of 24 inactive uranium mill tailings disposal sites and several thousand associated vicinity properties, again as mandated by public law. In fiscal year 1986, our plan is to have remedial action underway at 7 processing sites and over 400 vicinity properties will have been cleaned up. By the end of that year, then, we will have completed work on the first 3 of the 24 UMTRAP sites and our planned pace is to complete all of the work at these sites by 1990, consistent with the schedule currently mandated by Congress.

Under our Surplus Facilities Management Program we are providing for the safe management and disposition of contaminated Department of Energy civilian program facilities. These are currently grouped into about 34 projects, and they are for facilities no longer in use. The major one of these is the decontamination and decommissioning of the Shippingport Atomic Power Station in Pennsylvania, which will be the first demonstration of the safe and economical cleanup of a commercial power reactor.

Another major waste management activity for which we have responsibility is the demonstration of high-level waste solidification at the Western New York Nuclear Center near West Valley, and we're performing that work, again, in accordance with a separate public law. In fiscal year 1986 the West Valley program will focus on verification testing of the vitrification system in the component test stand and on the construction and startup of the supernate treatment system. Solidification of the waste at that site is actually scheduled to begin in 1988, with completion scheduled in 1990. And as you know, we have continued to periodically report to Congress on the progress of that project.

Madam Chairman, in the interests of time this completes my overview statement. I do—and have submitted—a more detailed additional statement for the record which does cover each of these programs in more detail.

I have with me also today William R. Voigt, Acting Director of the Office of Terminal Waste Disposal and Remedial Action, as well as several others.

[The prepared statement of Mr. Vaughan follows:]

STATEMENT OF
JAMES W. VAUGHAN, JR.
ACTING ASSISTANT SECRETARY FOR NUCLEAR ENERGY
DEPARTMENT OF ENERGY
BEFORE THE
SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

FEBRUARY 26, 1985

OVERVIEW

Madam Chairman and Members of the Subcommittee, I am pleased to be here today to discuss the Department of Energy budget for Nuclear Waste Technology and Remedial Action programs. Although the Remedial Action programs are not research and development oriented, they have always been of interest to this Committee. Our Nuclear Waste Technology funding request for FY 1986 is $11.7 million in budget authority, as compared to the $13.0 million appropriated in FY 1985. The FY 1986 budget request for the Remedial Action program is $233.0 million, an increase of $73.0 million over the FY 1985 appropriation.

Before providing an overview of these programs, I want to assure you that the Department takes very seriously its responsibilities to perform remedial actions to clean up the environment within the several programs covered in this appropriation. This work is important and necessary to correct the legacies that in many cases have been left over from programs completed a number of years ago at sites which are no longer actively in use. We have established appropriate priorities for these programs on the basis of contamination levels and the proximity of public activities, and we are proceeding at a reasonable and technically acceptable pace to accomplish these goals, and at the same time we are continuing our monitoring and surveillance activities to assure that none of the sites will create a health or safety hazard for people in surrounding areas.

FY 1984 and 1985 activities in a number of these projects have been characterized by overall program planning, engineering preparation, and establishing cooperative agreements with the States, Indian tribes, municipalities, and industrial concerns involved at the various sites. In addition, work has been initiated at the highest priority sites. To maintain the schedule for this work, we anticipate the need for higher funding levels in the next 2 years, as we move from the planning and engineering stages to the actual performance of work at additional sites.

Because of the Department's strong commitment to completing these cleanup efforts, we have elected in balancing our budget priorities to continue these programs at levels only slightly below previous outyear funding projections rather than maintaining them at FY 1985 funding levels. To have chosen the latter course would have entailed unnecessary delays in completing many of the projects, with resulting increases in the total costs to the Government over the period of work.

I would like now to provide a brief overview of these programs. I have a more detailed statement that I would like to submit for the record.

The funds requested for Nuclear Waste Technology are distributed among the program elements as follows:

Program Element	FY 1985	FY 1986
	($ in Millions)	
Low-Level Waste	$ 6.2	$ 4.8
Waste Treatment	6.3	6.4
Program Direction	0.5	0.5
Total	$13.0	$11.7

The role of DOE's Nuclear Waste Technology program is to assist the States and regions in developing a reliable national system for managing commercial low-level wastes and to develop technologies that will safely and effectively treat and immobilize nuclear fuel cycle wastes -- low level, high level, and transuranic. In 1980, legislation was enacted assigning States the responsibility for disposal of low-level nuclear wastes. Our Low-Level Waste program continues to provide technical assistance to the States, and it has been useful in getting proposed regional compacts presented to the Congress for consent. In this regard, we have responded this month to Congressman Udall's questions on the criteria that should be used to evaluate proposed regional compacts.

In the Waste Treatment program, we conduct the research and development necessary to reliably solidify high-level and transuranic wastes for transportation, storage, or disposal. Our major FY 1986 effort in waste treatment will be to complete the last phase of development of the process for incorporating high-level waste into a borosilicate glass form acceptable for disposal. In November 1984, the Department entered into a collaborative research and development project agreement with the Federal Republic of Germany on process controls and operation of a facility for solidification of high-level radioactive waste. As part of this exchange, the radioactive liquid-fed ceramic melter at the Pacific Northwest Laboratory will be operated over a period of several months in FY 1985 and FY 1986. At least 10 and as many as 30 canisters of radioactive borosilicate glass will be produced and subsequently used by the Federal Republic of Germany for testing purposes in their waste management program.

REMEDIAL ACTION PROGRAMS

The funds requested for the Remedial Action program are distributed among the program elements as follows:

Program Element	FY 1985	FY 1986
	($ in Millions)	
Formerly Utilized Sites	$ 18.0	$ 17.7
Grand Junction	1.5	0.9
Uranium Mill Tailings	62.0	110.0
Surplus Facilities	29.5	39.0
West Valley Demonstration Project	47.9	64.0
Program Direction	1.1	1.4
Total	$160.0	$233.0

Our program for remedial action at certain contaminated facilities and sites is divided into five major activities, two of which are being conducted pursuant to the Department's responsibilities under the Atomic Energy Act as amended, and three in accordance with separate public laws.

(1) The Formerly Utilized Sites Remedial Action Project (FUSRAP) covers non-Government former nuclear processing sites that require stabilization or removal of contaminated material. DOE currently has authority to conduct remedial action at 25 sites. In FY 1986, remedial action will focus on continuation of ongoing efforts at the highest priority sites, located near Niagara Falls, New York; Wayne, New Jersey; Middlesex, New Jersey; Maywood, New Jersey; Colonie, New York; and Hazlewood, Missouri.

(2) A second project covers our participation in a Federal/State cooperative effort, mandated in Public Law 92-314 as amended, to remove uranium mill tailings used for construction

purposes in Grand Junction, Colorado. By the end of FY 1986, we will have completed remedial actions at 576 of the estimated 604 structures requiring attention. Completion of the remainder is planned for FY 1987.

(3) The Uranium Mill Tailings Remedial Action Project (UMTRAP) is directed toward the cleanup of 24 inactive uranium mill tailings disposal sites and several thousand associated vicinity properties, as specified in Public Law 95-604. In FY 1986, remedial action will be underway at 7 processing sites, and over 400 vicinity properties will be cleaned up. By the end of the year, we will have completed work on the first 3 of the 24 UMTRAP sites. Our planned pace is to complete work at all the UMTRAP sites by 1990, consistent with the schedule mandated by Congress.

(4) The Surplus Facilities Management Program (SFMP) provides for the safe management and disposition of contaminated DOE civilian program facilities (currently grouped into about 34 projects) that are no longer in use. The major project under this program is the decontamination and decommissioning of the Shippingport Atomic Power Station, which will demonstrate the safe and economical cleanup of a commercial power reactor. In FY 1986, the Shippingport project will continue at a pace consistent with completion about 1-1/2 years later than originally planned, as a

result of making choices of priorities within our Departmental budget constraints.

(5) Another major waste management activity for which we have responsibility is the demonstration of high-level waste solidification at the Western New York Nuclear Center near West Valley, as specified in Public Law 96-368. In FY 1986, the West Valley program will focus on verification testing of the vitrification system in the Component Test Stand and on the construction and startup of the supernate treatment system. Efforts will continue on engineering and procurement of waste solidification support systems and decontamination and decommissioning of the facility. Solidification of the wastes is scheduled to begin in 1988, with completion scheduled for 1990.

Madam Chairman, this concludes my formal statement. I would like to submit for the record attachments to my statement, which cover the Department's Nuclear Waste Technology and Remedial Action program activities in greater detail. I have with me today William R. Voigt, Jr., Acting Director of the Office of Terminal Waste Disposal and Remedial Action, John E. Baublitz, Director of Remedial Action Projects, and Joseph A. Coleman, Director of Storage and Treatment Projects. We would be pleased to respond to any questions you may have.

ATTACHMENT FOR THE RECORD
DETAILED STATEMENT OF
JAMES W. VAUGHAN, JR.

FEBRUARY 26, 1985

NUCLEAR WASTE TECHNOLOGY

The goals of the Nuclear Waste Technology program are (1) to help in facilitating the development of a nationwide system, through a series of regional compacts, for managing low-level wastes (LLW) and (2) to develop technologies for treating and immobilizing nuclear fuel cycle wastes.

The Low-Level Waste program provides technical assistance to States in developing regional capabilities for the disposal of low-level radioactive waste, in accordance with Public Law 96-573, the Low-Level Radioactive Waste Policy Act. The Waste Treatment program conducts research on high-level, transuranic, and sodium-contaminated wastes and develops and transfers technologies for the treatment and immobilization of spent nuclear fuel in forms that are suitable for transportation, storage, and ultimate disposal in a geologic repository.

Low-Level Waste

The Low-Level Radioactive Waste Policy Act assigned to the States the responsibility for disposal of low-level wastes generated within their borders, with the exception of wastes generated as a result of certain Federal activities. The formation of regional compacts to carry out this responsibility was encouraged by the Act. The goal of the Department's Low-Level Waste program is to assist States and regions in the development of an effective nationwide low-level waste management system by 1988, and to evaluate the system in terms of operational efficiency by 1990. The Department anticipates that Congress will be asked for its consent to the formation of some five to eight regional compacts in 1985.

During FY 1985, the Low-Level Waste program will continue to provide technical asistance to States and regions for the development of new disposal facilities and for plans to stabilize and close disposal sites no longer in operation. The Department will also continue to assist Congress in its review of proposed regional compacts. DOE expects to finish development of the procedures that will be used to evaluate proposals for transfer of closed low-level waste sites to the Department under the provision of Section 151 of the Nuclear Waste Policy Act of 1982.

In FY 1986, the Low-Level Waste program will provide technical assistance to a limited number of States and regions to support the selection and development of new low-level waste disposal facilities; support the correction of problems and the stabilization at existing disposal sites; and complete an assessment of advanced, innovative methods for the treatment and disposal of low-level waste.

Waste Treatment

The major objective of the Waste Treatment program is to complete the final phase of development of the process and system for immobilizing high-level wastes in a borosilicate glass waste form. A vital part of the effort is learning how to produce canisters of this waste in glass that will meet storage and repository disposal requirements. Technology transfer is being accomplished through close working relationships with other Departmental waste treatment programs, such as those at West Valley, New York; Savannah River, South Carolina; and Hanford, Washington. Activities in this progam are also coordinated with other Departmental efforts related to fuel reprocessing, generation of special wastes, transportation, and terminal isolation of high-level waste and spent nuclear fuel.

In FY 1985, a major testing program began with the operation, at Pacific Northwest Laboratories in Richland, Washington, of a pilot-scale Liquid-Fed Ceramic Melter (LFCM) in the radioactive mode. This testing and evaluation program is designed to demonstrate operability and maintainability in a remote radioactive environment. Also, equipment and process control correlations will be developed to produce high-quality glass products and to minimize the need for preoperational (nonradioactive) testing of future full-scale production systems. International participation in this testing program by the Federal Republic of Germany and Japanese governments is being accompished through specific project agreements. Additionally, a modest level of effort will be initiated in FY 1985 toward developing an acceptable second-generation high-level waste form that will be more cost-effective, accommodate higher waste loadings, and perform satisfactorily at the higher temperatures. Transuranic (TRU) waste treatment technology will continue to be evaluated on a limited basis. Criteria and guidance for shallow land burial of sodium-contaminated wastes were completed as scheduled in FY 1984, and a final program report will be issued in FY 1985.

FY 1986 will mark the second year of the effort to determine the operational reliability, remote maintainability, safety, and process control flexibility of the ceramic melter system for solidification of high-level radioactive wastes. Efforts will continue on the development of a series of melter system design, testing, operation, and decommissioning handbooks for purposes of transferring this technology both to the private sector and to other government organizations involved in waste solidification programs. Candidate materials and processes will be evaluated to develop a second-generation waste form for the disposal of less-aged high-level nuclear wastes anticipated after the year 2000. Three of the most promising candidate waste forms will be selected for further development. TRU waste streams typical of commercially generated wastes will be quantified, their relationship to high-level waste treatment solutions will be defined, and new or improved treatment technologies will be developed.

REMEDIAL ACTION PROGRAMS

The objective of the Remedial Action program is to treat or stabilize radioactive wastes and to perform decontamination and decommissioning at contaminated DOE sites and at legislatively authorized non-Government facilities and sites. The major activities are: (1) the Formerly Utilized Sites Remedial Action Project (FUSRAP); (2) remedial action at Grand Junction, Colorado (Public Law 92-314 as amended); (3) the Uranium Mill Tailings Remedial Action Project (UMTRAP) for inactive uranium mill tailing sites (Public Law 95-604); (4) the Surplus Facilities Management Program (SFMP), for certain radioactively contaminated DOE facilities declared surplus and resulting principally from civilian nuclear energy programs; and (5) demonstration of the solidification of high-level radioactive wastes at West Valley, New York, for final disposal (Public Law 96-368).

Formerly Utilized Sites Remedial Action Project (FUSRAP)

FUSRAP provides for remedial actions at former nuclear processing facilities, now privately owned, which became radioactively contaminated as a result of Manhattan Engineering District or Atomic Energy Commission activities and which have not been decontaminated sufficiently to meet current public health and safety guidelines. FUSRAP also includes contaminated sites specifically assigned to DOE by Congress for remedial action.

To remedy the situation at these contaminated sites, either the contaminated material will be stabilized in place, with restrictions placed on the use of the site, or the contamination will be removed and disposed of at another location. Authority currently exists, derived from the Atomic Energy Act of 1954, for conducting remedial actions at 20 sites, based on a review of the involvement of the Department's predecessor agencies in activities at these sites. In FY 1984, this review process led to the addition, by the Department, of the following 5 sites (included in the total of 20 cited above) to the project: Ashland sites 1 and 2 (Tonawanda, New York), the Seaway landfill (Tonawanda, New York), Mallinckrodt (St. Louis, Missouri), and W.R. Grace (Curtis Bay, Maryland). Review of other sites involved in past activities of the Department's predecessors is continuing and may result in the addition of other sites to the program.

Congress added four new sites and $5.0 million in the FY 1984 Energy and Water Development Appropriation Bill, with direction to initiate a decontamination research and development project at these sites as a priority action.

In the FY 1985 Energy and Water Development Appropriation Bill, Congress directed the Department to acquire the former St. Louis Airport site and use it to dispose of waste from cleanup of the nearby Latty Avenue site and vicinity properties. Congressional and Departmental additions bring the total number of sites in the project to 25.

The Department's Oak Ridge Operations Office has the lead role in implementing the Formerly Utilized Sites Remedial Action Project (FUSRAP).

In FY 1985, the Department expects to complete cleanup work at the 23 contaminated properties near the DOE-owned Niagara Falls Storage Site in Lewiston, New York. Work will continue on the installation of an interim cap on the waste storage area and will be completed by December 1985. Other remedial actions at this site are described under the Surplus Facilities Management Program. The Department is also planning to continue the remedial actions at the Middlesex Landfill in New Jersey, to be completed by December 1985. This is about a year later than originally planned, due to a large increase in the estimated volume of contamination and the limitation on funds. The discovery that the volume of contaminated soil at the landfill is 5 times the amount originally estimated illustrates the difficulty of predicting the amount of contamination when it is deeply buried. Material contaminated with uranium and its decay products is being excavated from the landfill and stored temporarily at the nearby DOE-owned Middlesex Sampling Plant.

Decontamination actions begun in FY 1984 will be continued in FY 1985 at Maywood, New Jersey; Wayne/Pequannock, New Jersey; Colonie, New York; and Hazelwood, Missouri. The general approach to these projects is to give priority to the cleanup of contaminated residential properties and to store the waste temporarily on each processing site. The cleanup of residential properties associated with the Maywood site will be completed in FY 1985, and cleanup of commercial properties will be started. In FY 1986, cleanup of the Maywood commercial properties will be continued, with a goal of completion by the end of FY 1987. The waste from this site is being stored on the Stepan Company property at Maywood under a no-cost lease. The Department is studying options for stabilization-in-place of the more than 200,000 cubic yards of waste, or removal to a new disposal site in New Jersey.

At Wayne, New Jersey, the cleanup of a ballfield and a bus yard will be completed in FY 1985, as will the engineering of the cleanup of the adjacent Sheffield Brook site. In FY 1986, the cleanup of Sheffield Brook will be completed. W.R. Grace donated the Wayne site and $800,000 to DOE in September 1984. Modifications are being made to the site so that wastes can be stored on the site temporarily. The site is considered unsuitable for permanent stabilization. The State of New Jersey has been requested to nominate candidate locations in the State for DOE to establish a site for disposal of the estimated 50,000 cubic yards of waste at Wayne, as well as the other FUSRAP waste at Middlesex and Maywood.

At Colonie, New York, DOE acquired the NL Industries site as a donation in February 1984, along with two adjacent parcels owned by the Niagara Mohawk Power Company that have waste buried on them. In FY 1985, the shipment of hazardous chemical wastes from the former NL plant to an approved disposal site will be completed. Radiological surveys of a total of 56 properties will also be completed. Cleanup of 11 sites was completed by October 1984, an additional 25 properties will be cleaned up by October 1985, and the remainder will be completed by October 1986. The contaminated soil is being stored inside the plant. The Department is studying options for the stabilization-in-place or removal of the more than 30,000 cubic yards of waste to a new disposal site in New York. The State has been requested to nominate candidate locations for a DOE disposal site in New York.

At Hazelwood, Missouri, DOE has arranged with the site owner, Futura Chemicals Company, to use a part of the site for storage of contaminated soil. Cleanup of a portion of Latty Avenue, adjacent to the Hazelwood site, was initiated in FY 1984 and will be completed in FY 1985. Border areas on the site were cleaned up to prevent recontamination of Latty Avenue, and fencing was installed around the site. Radiological surveys of the vicinity properties will be completed in FY 1985. Cleanup activities will not be started until the waste can be moved to the St. Louis Airport storage site. Funds are included in the FY 1986 budget to prepare the engineering studies for this cleanup and transport. DOE has initiated discussions with the City of St. Louis, Missouri, for the acquisition of the former St. Louis Airport storage site for use in disposing of the estimated 60,000 cubic yards of waste from the Hazelwood site and vicinity properties, as required by language contained in the recent report that accompanied the FY 1985 Energy and Water Development Bill. If funds are available, the work at this site could start in FY 1987.

Work at other sites continued in FY 1984. Remedial action was completed at four laboratories at the University of Chicago. Preliminary engineering was completed for the radiological cleanup of the Middlesex Sampling Plant in New Jersey and the Bureau of Mines site at Albany, Oregon. A radiological survey report was prepared for the Dupont site in Deepwater, New Jersey. No further work will be done at these sites in FY 1985 and FY 1986, so that funds can be directed to work at the five highest priority sites.

A revision to the FUSRAP Project Plan is being prepared in FY 1985. A preliminary cost estimate of $640 million has been made for the current scope of FUSRAP, based on completion of all the work by the year 2001.

Grand Junction Remedial Action Project

Under Title II of Public Law 92-314, Congress authorized financial assistance to the State of Colorado to limit radiation exposure resulting from the use of uranium mill tailings for construction purposes in Grand Junction, Colorado. This State and Federal cooperative effort is administered by the Colorado Department of Health through DOE's Grand Junction Area Office. The remedial action provides for removal of uranium mill tailings from the premises of an estimated 604 structures where concentrations of radioactive radon and its decay products exceed guidelines established by the Surgeon General. Public Law 95-236 extended the time, which has now expired, for property owners to apply for inclusion and also increased the authorized funding for the program. Federal funds cover 75 percent of the program costs, with the State providing the balance. Contingent upon the availability of adequate funding from the State of Colorado, the remedial action is expected to be completed in FY 1987, with final radiological verification to be completed in FY 1988.

At the end of FY 1984, work had been undertaken on 559 structures. In FY 1985, radiological assessments will be continued, and remedial actions will be initiated at 10 additional structures, including 8 residences and 2 schools. In FY 1986, work is scheduled to be undertaken on 7 properties, including 4 commercial structures, bringing the total number of properties completed to 576 out of the estimated total of 604.

Uranium Mill Tailings Remedial Action Project (UMTRAP)

UMTRAP is responsible for conducting remedial action at 24 former uranium ore processing sites and several thousand contaminated vicinity properties, as mandated by Public Law 95-604, the Uranium Mill Tailings Radiation Control Act of 1978. Nine of the sites are designated as high priority, six as medium priority, and nine as low priority. The Act requires completion of the program by March 1990 to standards promulgated by the Environmental Protection Agency. Project implementation is proceeding on this basis, and the funding level requested for FY 1986 is required to maintain this schedule.

The program strategy is to focus near-term program activities on the higher priority sites and on vicinity properties. Remedial actions are being conducted in accordance with cooperative agreements negotiated with the affected States and Indian tribes. Federal funds cover 90 percent of the remedial action costs (100 percent for the sites on Indian lands). The type of remedial action for the processing sites will be to stabilize the mill tailings in place, where possible, or to remove them to a new disposal site. In either case, the final disposal sites will be Federally owned and maintained under Nuclear Regulatory Commission (NRC) licenses. Engineering plans and environmental documents are prepared for the cleanup and disposal operations at each site. Concurrences by the Nuclear Regulatory Commission and the affected State or Indian tribe are required for the remedial action plan at each site. The project also involves the cleanup of contaminated vicinity properties. It is estimated that some 4,000 to 6,000 vicinity properties, mainly in the Grand Junction area but not covered by the Grand Junction Remedial Action project, may be found to be eligible for cleanup under this project. The Albuquerque Operations Office has the lead role in implementing UMTRAP.

Specific accomplishments planned for FY 1985 include the completion of remedial action at Canonsburg, Pennsylvania, and initiation of remedial action at Salt Lake City, Utah; and Shiprock, New Mexico. The implementation of the remedial action at the Salt Lake City processing site has been assigned to the State of Utah. The approach at this site is to relocate the tailings to a site near Clive, Utah. Cleanup will also continue at high-priority vicinity properties near the sites at Canonsburg, Pennsylvania; Salt Lake City, Utah; Grand Junction, Colorado; and Edgemont, South Dakota; and will be started at Shiprock, New Mexico; Riverton, Wyoming; and Durango, Colorado.

During FY 1986, work will be underway at seven processing sites. The work at Salt Lake City will be brought to an estimated 40 percent of completion, and the work at Shiprock and Riverton will be completed. Onsite work will be started at the processing sites at Durango and Gunnison, Colorado; Tuba City, Arizona; and Lakeview, Oregon. Over 400 vicinity properties located at several high-priority sites will also be decontaminated.

Surplus Facilities Management Program

This program provides for the safe management and disposition of the inventory of surplus radioactively contaminated DOE-owned facilities from civilian nuclear energy development programs. The decontaminated facilities and sites are to be returned to other productive use, where appropriate. (All defense-related facilities are budgeted as Atomic Energy Defense Activities.) The facilities are grouped into 34 projects under this activity. A long-range plan will be completed by April 1985, to establish the overall schedule and priorities for sites currently in the surplus inventory. Priorities are established and work schedules are developed through analysis of legal, economic, and health and safety factors for each site. The Richland Operations Office has the lead role in implementing this program.

In FY 1984, the major onsite cleanup and upgrading of storage facilities was continued at the Niagara Falls Storage Site in Lewiston, New York. About 93 percent of the 4,000 cubic yards of residue stored in a 160-foot tower were transferred through a 3/4-mile pipeline to a low concrete building at the waste storage area. This major task will be completed in early 1985. A thick clay cap is being placed over the wastes to prevent water infiltration and is designed to perform satisfactorily for a minimum of 25 years. Installation of the cap is scheduled for completion by December 1985. Alternatives for the long-term management of these wastes were examined in an Engineering Evaluation of Alternatives report and in a draft Environmental Impact Statement (EIS). A final EIS is to be issued in FY 1985. A geohydrologic report on the site was also issued. In FY 1986, surveillance and maintenance of the site is planned. Implementation of a long-term management option would be deferred to use available funds for higher priority work.

Work on the reconditioning of contaminated facilities at the Mound Laboratories in Miamisburg, Ohio, will be continued in FY 1985 and FY 1986, reaching an estimated completion of

72 percent and 83 percent, respectively. This 10-year project was begun in 1978.

Responsibility for the Shippingport Atomic Power Station was turned over to this program from the Naval Reactors program in September 1984, as planned. A site office for DOE and supporting United Nuclear Corporation staff was established. The General Electric Company began maintenance activities at the plant, and planning for procurement of decommissioning operations subcontractors is underway. Physical dismantling of portions of the plant will be started in September 1985 and is scheduled to be completed in FY 1990, about 1-1/2 years later than previously planned, due to the need to establish priorities within Departmental budget constraints.

In FY 1984, the Department continued to carry out necessary interim site maintenance and monitoring and continued to plan long-term remedial actions at the Weldon Spring, Missouri, site. A geologic report and an Engineering Alternatives Analysis report were issued. In FY 1985, planning and engineering will be continued. A radiological survey report for the surrounding area will be completed. Maintenance actions will be completed on the raffinate pit (storage pond) dikes. Preparation of a draft EIS to be issued in 1985 is underway. The Department's preferred alternative is stabilization of the wastes onsite in a disposal facility designed to meet Environmental Protection

Agency requirements for the stabilization of uranium mill tailings. Under an agreement to be signed in the near future with the Department of the Army, DOE will assume responsibility for decommissioning the chemical plant portion of the Weldon Spring site and disposing of the resultant wastes. During FY 1986, the engineering for the remedial action at the quarry will be completed, with the objective of initiating quarry cleanup in FY 1987. The Weldon Spring site remedial action project will be a major DOE project, with an estimated cost of about $260 million (in 1986 dollars) and a duration of 9 to 10 years. The Army will provide 50 percent of the funds for this work. The Department plans to acquire a prime contractor for this project by competitive procurement in FY 1986.

Other activities in FY 1986 will include continuation of site and facility disposition projects at Monticello, Utah; Santa Susana, California; Argonne National Laboratory, Illinois; Oak Ridge National Laboratory, Tennessee; Idaho National Engineering Laboratory, Idaho; and the Center for Energy and Environmental Research (CEER) at Mayaguez, Puerto Rico. Decommissioning of the reactor facility at CEER will be completed in FY 1986. At Monticello, Utah, mill tailings will be removed from 15 residential properties, leaving only about 10 properties to be completed in FY 1987. Design engineering and environmental assessment will be completed at the mill site, to allow work on the site to start in FY 1987.

West Valley Demonstration Project

The objective of the West Valley Demonstration Project is to demonstrate the solidification process for disposal of high-level nuclear wastes under the provisions of Public Law 96-368, the West Valley Demonstration Project Act. An integrated production-scale development and demonstration project for treating high-level liquid nuclear wastes will be carried out at the Western New York Nuclear Service Center, near West Valley.

Major activities to be performed as part of this project include: (1) decontamination required to prepare existing facilities and equipment to accommodate the solidification project; (2) removal of wastes from underground storage tanks; (3) development, design, construction, and operation of systems and necessary supporting facilities for the solidification of the wastes; (4) acquisition of containers for the permanent disposal of the solidified waste; (5) temporary storage and transportation of the solidified waste to an appropriate Federal repository for permanent disposal; (6) decontamination and decommissioning of the waste tanks, facilities, hardware, and material used in carrying out the project; and (7) disposal of low-level and transuranic wastes produced from project activities.

The estimate of total project costs through the waste solidification stage, excluding final decontamination and decommissioning of the facility, remains at $472.8 million (escalated). A cost validation review is scheduled to begin in the second quarter of FY 1985. It is expected that the overall schedule will remain unchanged, and that the total project cost estimate will be reduced. The results of the validation review will be contained in an upcoming quarterly progress report to Congress on this project.

The major emphasis at West Valley in FY 1985 was to begin verification testing of the vitrification and supporting systems in the Component Test Stand, to accelerate the design and construction of the supernate treatment system (the supernate is the liquid above the sludge in the tank) for operation in FY 1986, to continue waste mobilization and removal testing in the one-sixth scale model waste tank, to continue upgrading the radwaste treatment systems, and to continue hot cell decontamination to obtain space for systems that support the waste solidification process.

The FY 1986 program will result in operation of the supernate treatment system, which will be used to remove a majority of the radioactive constituents. The supernate represents nearly 90 percent of the volume and 50 percent of the radioactivity of the stored liquid waste. The radioactivity removed will be stored and later blended with sludge and glass formers prior to being fed into the melter. Verification testing of the Component

Test Stand and one-sixth scale model waste tank will be completed. Major design activities associated with the waste removal, size reduction/TRU decontamination, high-level waste storage, and radwaste treatment systems will be completed, and procurements will be initiated as resources and designs permit. Decontamination of critically needed hot cells and of the spent fuel Receiving and Storage Area will be continued to meet project needs.

Mrs. LLOYD. We are awfully happy to have Bill Voigt with us today, as well.

I now see former member Mike McCormack with us. Congressman McCormack, we are happy to have you with us today and appreciate your presence as well.

We had acknowledged you earlier, but you had run out. We are glad that you came back in.

Mr. VAUGHAN. The last time we were here you expressed some interest in educational material for various of the Members. We have brought with us a couple of tapes which do show recent activities at a couple of these projects which are illustrative of the type of work being done. There's a 5 to 10 minute tape on the FUSRAP projects which we can show as much or as little of as you would like and there's about a 6 minute tape on the West Valley Project. We'd be glad to show those and then respond to your questions or proceed in any way the subcommittee would like.

Mrs. LLOYD. Well, I appreciate your bringing the films. We look forward to seeing them.

Mr. VAUGHAN. Would you like us to do that now?

Mrs. LLOYD. Yes, please proceed with the films.

Why don't we see the first film, Mr. Vaughan?

Mr. VAUGHAN. All right.

Mrs. LLOYD. And then we'll proceed with questions.

Mr. VAUGHAN. All right.

The first film will be of particular interest to Mr. Roe, I think——

Mrs. LLOYD. We appreciate you bringing the films. I think I said earlier, but your complete testimony will be made a part of the record.

Mr. VAUGHAN. Thank you.

[Videotape presentation made.]

Mr. VAUGHAN. I think that's a good place, Madam Chairman, to stop.

Mrs. LLOYD. Thank you very much, and I do appreciate you bringing the visual tape.

Mr. VAUGHAN. I would like, for the benefit of the members, if we showed one of a uranium mill tailings project. It would proceed along much the same lines and the same principles.

Mrs. LLOYD. Thank you.

I was interested in the funding contributions involving the companies that formerly utilized the site in Maywood. I was wondering why DOE is planning to spend $30 million over about 15 years that really is for waste that was generated by New Jersey, from the FUSRAP. How will this site be different from the regional low-level burial site under the Low-Level Waste Policy Act?

Mr. VAUGHAN. Well, there are two sites in New Jersey that frequently get linked with efforts by previous companies. The W.R. Grace Co. donated a site in Wayne, NJ as a donation, and they've contributed $800,000 to our decontamination R&D project——

Mrs. LLOYD. Was this site included in the Grace report, the Grace Commission? [Laughter.]

Mr. VAUGHAN. No, it is not the site of the Grace Commission. That's an interesting linkage.

Mrs. LLOYD. I thought it was a good thought. There are some areas that got left out.

Mr. VAUGHAN. The other company involved that's predominant in that is the Stepan Chemical Co., who are permitting use of the Maywood site for DOE's work at that site, and they are expected to make a similar contribution of property and funding support. Our goal is to get the companies to donate the land to DOE and to make as much of a monetary contribution as is possible. We work to get as much out of every one of them as we can.

Now, your question is, how is this different from the——

Mrs. LLOYD. The regional low-level waste depository.

Mr. VAUGHAN [continuing]. Low-level compacts? The regional low-level waste compacts really result from the normal day-to-day business of a utility, a hospital using radioisotopes for medicine or whatever, under license from the NRC to have that material disposed and buried. We are dealing, under the FUSRAP Program, with some sites which, for one reason or another, it's been determined that DOE has a responsibility from either our current authority or one of our predecessor agencies to have been responsible for the contamination that's residual on the site, either because standards have changed—when people moved it from one place to another to use it for landfill, it was moved from an activity that did it under DOE auspices, so we've been determined to have a responsibility for that whereas we do not have a responsibility for the normal commercial licensee to bury his waste in a normal low-level waste repository. I think that's the key difference.

Mrs. LLOYD. I'm going to defer now to Mr. Roe. I understand that he has another meeting to attend, and then I have another question or two after Mr. Morrison.

Mr. VAUGHAN. Sure.

Mrs. LLOYD. Mr. Roe?

Mr. ROE. I thank you, Madam Chairman.

At the outset, I'd like to say to Mr. Vaughan and his colleagues that in our association with his activities and being that the Wayne site is in my district, I'd like to say that your people have done a good job. They have been on top of it; they have been very cooperative with me, and to that end we want to thank you at this point.

But I did want to bring up a couple of issues because, naturally, the melody lingers on because the material is still there, and we've got a million things yet to do.

I noted that in your presentation on page 5 that we're reducing the 1986 request from $18 million to $17.7 million; but then, in analyzing further your testimony, you indicate that of the number of sites involved there are four or five that are considered to be top priority, of which Wayne is one of those. Therefore my question would be, for the record, that albeit the point of view that you're asking for a few hundred thousand dollars less than last year, will that in any way denigrate or delay or whatever the cleanup on the Wayne site as presently projected? Or should we be asking for additional help?

Mr. VAUGHAN. With the funds that have been identified in fiscal year 1986 and are planned in the following years, Wayne and the other high-priority sites will proceed at the previously scheduled pace and will not be delayed.

Mr. ROE. Let me ask a little bit more on that. I noted in a recent report that there has been a change in criteria, and a strengthening of the criteria; therefore, the materials to be moved from one section known as the ballfield section, I think Jack has that answer—has now increased—in other words, there's a larger amount of material involved—which would indicate to me that it's going to take more trucks, et cetera, more effort to be able to put that material in temporary storage. Does that affect it in any way if you're going to go by that new criteria, or is that all part of the priority?

Mr. VAUGHAN. Madam Chairman and Mr. Roe, this is Jack Baublitz who is our director of the Remedial Action Programs, who had asked to come to the table with me.

The short answer to your question is no, it won't affect it, but let me let Jack give you a couple of sentences elaboration on that since he's the expert.

Mr. BAUBLITZ. That is correct, Mr. Roe. The criteria change was one in which we adopted a more conservative attitude toward the cleanup actions. As a result, there is a larger amount of material that will be removed from the ballfield than our original estimates. However, the planned budgeting and pace as identified by Mr. Vaughan will be adequate to include that increase——

Mr. ROE. To keep that schedule that we laid out?

Mr. BAUBLITZ. Yes, sir.

Mr. ROE. Let me ask another question. It seems to me that we had requested originally $2 million, which was included in the authorization and funded for this first phase. Then we had identified, in a cost estimate, approximately $19 million to permanently store the material in this site, which we are totally opposed to, and I believe your department has also recommended that it should not be retained there permanently. In fact, there is representation in the testimony to that effect. In other words, $21 million to move it somewhere else in New Jersey and $30 million additional to move it to Oak Ridge.

My next question would be, as I look over the activities in the Northeast, including my own State, in designating low-level radiation materials storage, that there seems to be not only confusion but that program doesn't look to me like it's moving too fast. You want to give us a little response to that?

Let me just interject one more thought because I think it'll help you. As I read the last report, Pennsylvania has been negotiating with Maryland, West Virginia, and Delaware on a possible repository in the State of Pennsylvania, and New York is talking about going it alone. Connecticut is doing something else, and apparently that coordination, that getting all those States together, is kind of falling apart a bit. Do we have any update as to what you see happening there, now?

Mr. BAUBLITZ. We have formally requested the State of New Jersey for the FUSRAP waste in New Jersey to identify a location in the State for DOE to establish a disposal site.

Mr. ROE. Is that a formal request, made to New Jersey already?

Mr. BAUBLITZ. Yes, it has been, in letter form to the Department of Environmental Protection.

The distinction I'd like to draw is between this request for the State to take a lead in identifying a location for us to establish a DOE disposal site, and the efforts that the States currently have underway which you are referring to, for forming compacts under the terms of the Low-Level Waste Policy Act. We have recognized that, as Mr. Vaughan pointed out, the waste that is produced by these programs is DOE waste, Federal waste. In addition, by and large, it is by-product material rather than low-level waste and as such it is not really subject to the provisions formally of the Low-Level Waste Policy Act. It is DOE's responsibility to dispose of that material. We do believe, however, that the State has an important role, and we've asked the States as a result to take the lead in identifying locations.

We have also told the States that, at their option, if they would prefer that a low level compact site be utilized for this kind of purpose instead of establishing a separate DOE site, that we would certainly consider that, as well.

Mr. ROE. Well, what's leading to my concern is obvious, and I think you've closed the circle on that whole situation. Our people are saying to us, "Well, OK, you've got the first step taken," which they are appreciative of, and they're appreciative to the Department for the work they've done. But we're kind of up in limbo at the point of view that we're not making the existing site a permanent repository, which we've agreed it should not be—not only from our point of view, directly, technically, and emotionally, but from also the point of view of the Department. Then we're coming to a point of view of saying, "Well, OK, we have two options there because of the type of materials involved," that we could either hopefully make some arrangement with the State of New Jersey when it gets at that point, to be able to deposit it in a State site, and/or the establishment of a DOE site in the State to accommodate some of these materials. Is that a correct understanding of the issue?

Mr. BAUBLITZ. Yes, sir.

Mr. ROE. Now, having said that, and looking over the schedule that we had outlined up in the State, come 1986 fiscal year we're beyond that point now. We've got to do something more if we're going to do it, assuming that—as pointed out by Mr. Vaughan—

yes, we will follow the priority schedule; yes, we will get to that point; that's fine. But it leaves open a major issue in my mind of what we do and where we put that material.

My next question would be, then, in the absence of the State taking some definitive action as far as the Low-Level Radiation Depository Act is involved, what time along the time frame is DOE going to be triggered on whether they should take some action on this?

Mr. BAUBLITZ. We fully expect that because of the obvious sensitivities about locating a disposal site, whether it be DOE or a compact site, that the process involved in locating, establishing, and making ready such a site is going to be a rather lengthy one, maybe 10 years. We are preparing, therefore, in our work at Wayne and the other sites presently, to put all the materials that we collect from these vicinity properties, other locations, in a condition at the temporary storage site which will adequately protect it and keep it under control for a period of that length of time.

Mr. ROE. Why 10 years?

Mr. BAUBLITZ. That's an arbitrary number, Mr. Roe. Our designs are typically based on criteria that are good for longer than that. Usually we're designing containment principles based on 25-year containment, but 10 years is an estimate we've made of the length of time it may be required to establish a disposal site.

Mr. ROE. Well, what we're saying, then, basically, the work that was being done on a priority basis to get the first instance of containment involved is really not a short-term containment. It may not be considered to be a permanent containment, but it's not a short-term containment, either. You know, 10 years to me is not a short term. I think you'd agree with that.

So are we saying that we have, what, about another 12 or 14 months for the State to make a decision under the original law, and there's some talk as to whether that role would be extended, and/or DOE moving. Has DOE made any decisions or done anything in the States such as New Jersey, because of our problems, to look into a possible site? Or is that still in negotiation or in limbo?

Mr. BAUBLITZ. We're still in a position where we're working with the State, asking them to take essentially a lead role in establishing a location, but agreeing to commit funds from our budget to assist in that selection process, which would likely include certain kinds of analyses, sampling, and testing, for example.

Mr. ROE. Well, basically, what we're saying is, will you need more work in this direction?

Mr. BAUBLITZ. Yes.

Mr. ROE. That gets back to the point of view when we're talking about—if I may, Madam Chairman—we get back to the point of view of the level of funding. In effect, all I can report to my people today is, No. 1, that you're doing a good job at this stage of review—and I say that sincerely, because I know how hard you personally and your colleagues have worked on that—and No. 2, however, I can give them no hope for a minimum of 10 years of getting that material out of there en toto, is really what it amounts to. Unless we take some other action.

Let me ask you a question. Realizing the sensitivity of finding a site and realizing the technology involved, are we looking at any possibility of utilizing existing Government sites, maybe military sites, in any of the States? For example, Fort Dix is a large area in my State. In fact, it's a very large geographical area. Are we doing anything to accelerate that?

Mr. **Baublitz**. We, ourselves, are not; and we're not specifically aware of what locations the State may be evaluating under their various aspects of looking for sites. Our limitation currently is one of considering the use of existing DOE sites, and the only one that currently exists that has capacity of the kind that might be required for these large amounts of low-contaminated material would be the site at Hanford.

Mr. **Roe**. But then we get to the point where the Federal Government has come back and said, well, we're planning on phasing out—as I understand it, correct me if I'm wrong—by January 1, 1986 the three existing sites that are presently used at this time? Is that correct?

Mr. **Baublitz**. That data, I believe, refers to the commercial sites.

Mr. **Vaughan**. Yes. I think you've got two subjects transposed, there. The phaseout is of the three commercial low-level waste disposal sites. That does not refer to DOE's use of its Hanford site or other DOE property sites.

Mr. **Roe**. OK. So that we're saying that the only thing that's on the table now that could immediately or thereabouts solve a problem of this nature is if these materials were moved from this site to one of the Federal sites?

Mr. **Vaughan**. Except that we are fully confident that the effort of stabilization in place that Mr. Baublitz described for the interim storage, pending final removal, will not create a problem for anyone with respect to any public health and safety concerns.

Mr. **Roe**. Well, that may be an observation, but that doesn't play in Wayne, NJ because our people are desperately concerned about it. I'm not playing games with you; I'm just trying to build a case now. In effect what we're saying, as far as my State is concerned—and I mean no effrontry to anybody in this room—that we've got to look for 10 years unless some movement is made in some direction to move that material out of there sooner. Or we have to come back to the Federal Government and write into the law and say, "Hey, guys, this is just not satisfactory. Pick up the material and move it out to Hanford." And with all due respect to my dear personal friend from the great State of Washington—and I went to school in Washington, so I want you to know I'm not exactly a foreigner to the State of Washington. And I'm not being facetious. I think there's where we're at at this moment, and unless we can——

Mr. **Vaughan**. Well, your statement is correct, Mr. Roe. We're trying to proceed within all the constraints of doing what is technically right as well as within the constraints of the law, and the way you've outlined the choices is exactly correct.

Mr. **Roe**. Well, that's what we're here for, to review the law. There may be some changes needed in the law.

There's one other point—and I didn't mean to monopolize or take this much time, but I think it's important—we have that Pequannock site which has, I think—what is it, 300 yards—

Mr. BAUBLITZ. Yes, sir.

Mr. ROE [continuing]. And that's in limbo, too, until we decide whether it's just going to stay there temporarily, or unless we move that material out again to one of the depositories, which is possible.

Mr. BAUBLITZ. That's correct. Relatively speaking, it's a small amount of material. We estimate 300 cubic yards, and it is not a safety or health hazard where it is, a relatively remote region there by the railroad tracks. We've determined that it can safely remain there until we determine a final disposition of the material at Wayne.

Mr. ROE. Well, except for a point of view that it's accessible to the people now. It hasn't been delineated or fenced and all of that bit as yet. Isn't that correct?

Mr. BAUBLITZ. That's right. It's still accessible. The concentration of material and its disposition there is such that it is not a hazard for the normal use of that site. If somebody—if you moved the tracks and built a house——

Mr. ROE. You were in Wayne. Did you ever try to tell one of the mothers that? It's just not good enough.

Mr. BAUBLITZ. Yes, sir. I recognize the problem.

Mr. ROE. Well, fine. The distinction I'm trying to draw for the committee's advantage here is, here is one site that the Department is moving ahead in its designated direction that the law directed them to do; and with the help of this committee in providing the funding that was necessary, the prioritization, and so forth, they've gone to a certain point. But the problem we're faced with is, we have that material now—I can envision storage being all over the State, Maywood, here, there, and whatever, and no place to put it. And we're not going to shorten the 10-year time unless some decision is made and we go to work on the technology involved and the review or the investigation of a site in a State or multiple States or whatever. Unless that's done, it's just going to continue to lag. Is that a reasonable observation?

Mr. BAUBLITZ. We would certainly like to see some accelerated movement with regard to selection of a New Jersey disposal site, yes, sir.

Mr. ROE. Thank you, Madam Chairman.

Mr. VAUGHAN. And we would appreciate any help you could give us in that regard, Mr. Congressman.

Mr. ROE. Well, you're running into that issue in other States, obviously.

Mr. BAUBLITZ. Yes, sir.

Mr. ROE. Well, what are we talking about there? Are we going to make that date—what was it, 1988 sticks in my mind; is that the date that was set—1986; if it's true in my State, what's happening throughout the country on that? Just to help us with our thought processes.

Mr. BAUBLITZ. In fact, the only site that we have in our pocket, so to speak, for disposition of the materials on these four R&D sites is the St. Louis Airport site which, as a result of work this committee undertook last year, was assigned to the Department, or will be accepted by the Department in the near future for disposal of the material at the Latty Avenue site.

Mr. VAUGHAN. Again, in your question, Mr. Roe, I think we again transposed the date for the low-level waste compacts with the separable question of DOE's responsibility to dispose of its material for which it is responsible under these various remedial action programs. We keep crossing over that distinction here. And so the date of 1986 that you referred to is the target date for the regional compacts to be in effect.

Mr. ROE. I understand what you're saying. You're saying that OK, fine, we've got two different programs; I realize that. But you also have a program for establishment of a DOE site. What is DOE doing to establish a possible site? Have we done anything yet?

Mr. BAUBLITZ. We've communicated our needs to the States and have been awaiting their response.

Mr. ROE. All States, Jack?

Mr. BAUBLITZ. Well, the three in question specifically at this time, based on the current sites, are New York, New Jersey, and Missouri. We have had meetings with staff-level contacts in each of the States and there is a willingness to discuss the problem and an understanding of the need, but as of yet there has been no specific action taken.

Mr. ROE. All right.

Thank you, Madam Chairman.

Mrs. LLOYD. Thank you very much, Mr. Roe.

Mr. Morrison?

Mr. MORRISON. Thank you, Madam Chairman. I will attempt to hold these questions down and would like to submit some of them in writing, Mr. Vaughan, if that's acceptable to you and your people.

Mr. VAUGHAN. Certainly.

Mr. MORRISON. Just a quick comment on the low-level compacts, since you included it in your comments, even though it's not under the jurisdiction of this committee; but just to express the frustration on the part of a region which has, in good faith, come up with a location and request to the Congress—all the States have passed their versions of that legislation—I just, again, share that concern. And in our State, very frankly, it spins off into the high-level question, and that is if Congress establishes ground rules in one area and then will not follow through with the ratification of those compacts, what happens in the high-level nuclear waste area?

Mr. Vaughan, I appreciate your mentioning the fact that we jointly dedicated this ceramic melter system. I have great confidence in that and will be asking you for a little more detail in my written questions.

I want to concentrate in the few minutes I have, though, on the issue of source materials for food irradiation, and wondered—for either you or Bill Voigt—would there be any logistical difficulties or operating problems if the Byproducts Beneficial Use Programs are transferred from Defense Programs at DOE to Nuclear Energy?

Mr. VAUGHAN. Mr. Morrison, following up some of our previous informal conversations on that subject, the only funding that is currently available within the Department of Energy for the use of any waste byproducts is under the Defense Programs organization because that's where the byproducts come from in terms of operating their production reactors. If there were to be funded some program within the Department by this committee or others for civilian applications for such isotopes, then it would normally fall within the province of my organization to carry out those efforts for civilian applications. And I don't think we'd have a big logistical problem making that happen.

Mr. MORRISON. Strictly a financial problem?

Mr. VAUGHAN. Strictly a financial problem.

Mr. MORRISON. OK. Thank you.

Mr. Vaughan, as you're aware, thanks to the experts you've sent to my office, we have a shortfall of available source material for beneficial use applications, including food irradiation, which I think will break rather quickly when the Food and Drug Administration announces their new regulations. Can you give us any indication, for this subcommittee, of what programs are under review for increasing our supply of cobalt-60 or cesium-137?

Mr. VAUGHAN. Again, let me just iterate that I will respond generally to your questions, recognizing that I'm responding in an area which is not directly under my purview within the Department, and so giving you a little bit of feel for my personal knowledge, secondhand. And if you would like some more detail we'd be glad to comment for the record.

As I understand it, there probably are something in the neighborhood of 100 million to 150 million curies in waste tanks that would somehow have to be processed in order to encapsulate it. And in this case, I'm referring to cesium-137 as a waste byproduct. There are obviously, for the subject of food irradiation, objectives in the industry to utilize cobalt instead of cesium. It's much less messy to handle, if I can use that expression. And again, as you well know, Canada has a much bigger market in the production of cobalt-60 than we do. I suspect that if we went to try to make cobalt-60 in existing Department of Energy production or test reactors, and to make the cobalt-60 incidental to that, we would probably be in the vicinity of 4 million to 10 million [1] curies a year, which is not a large number. But that's a subject we would have to evaluate in some detail.

Again, somebody's going to have to establish the need for this and the demand, and so it would have to be an iterative process.

Mr. MORRISON. OK, thank you. I appreciate that.

My other questions revolve around the distribution of the material that we currently have, and I think I will submit those to you in writing, merely with the expression of some concern about the distribution process. We have some domestic operators who are ready to use the material immediately, and I would like to—and I think the subcommittee would be interested in perhaps some further enlightenment on the procedure the Department is following in this distribution procedure.

Mr. VAUGHAN. We would be glad to respond to those for the record, and that would help us give you a coordinated response, together with the office that currently has custody of those byproducts.

Mr. MORRISON. OK. Thank you very much.

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[1] The correct numbers are 1 to 5 million.

Thank you, Madam Chairman.

Mrs. LLOYD. Thank you very much, Mr. Morrison.

Mr. Vaughan, I also have some questions that I would like to submit in writing for you to reply, to be made a part of this record. Because of a death in my family I am going to have to leave, and Mr. Lundine has graciously agreed to chair the committee.

Thank all of you—Mr. Rusche—thank all of you for being here this afternoon.

Mr. Lundine?

Mr. LUNDINE. Thank you, Madam Chairman.

Mr. Monson?

Mr. MONSON. Thank you.

Mr. Vaughan, in your prepared statement you mentioned the remedial action work that is taking place in Salt Lake City. Do you believe that the cleanup and removal activities are progressing well and timely in order to ensure public safety there?

Mr. VAUGHAN. Mr. Monson, I believe they are proceeding timely and well. That's one of our highest priority projects. As you know, we worked out some additional agreements with the State last year; there was $8 million added in the budget for that particular effort. We reached agreement that we will move the material out into the desert near Clive instead of stabilizing it in place because of its proximity to an urban area. I believe things are progressing well with the State of Utah. As you undoubtedly know, that is a project in which the State asked if they could take over the management of the project as contrasted to us being the principal managers, and we were quite happy to agree to do that. And so, the real management of making it move is going to be more in the State's hands in that case than in our hands.

Mr. MONSON. Was that done on a different split on the costs than normal?

Mr. VAUGHAN. My memory is that the cost split for the basic project is 90–10, Federal Government 90, State 10 for the total cost of the project up to the equivalent of stabilizing in place; and that if we incur additional costs, which was considered to be technically acceptable but because of the additional cost to move the material out into the desert, I believe the cost share on that is 75–25.

Mr. MONSON. Based on my understanding of it, that has resulted in an anticipated savings to both the State and the Federal Government. Is this something that could be done elsewhere in order to achieve savings and to improve efficiency?

Mr. VAUGHAN. I'm going to ask Mr. Baublitz to come help me answer that level of detail because, first, I want him to confirm that it's resulted in a savings, because I'm not 100 percent sure of that fact.

Mr. BAUBLITZ. The estimates are looking that way. We don't have final numbers yet, but that's the way the bids were coming in.

As far as the applicability of that process to other sites, we are looking into it. Utah, as you're well aware, has some unique things to offer in this regard; because of their Federal Highway Program, the State has on its payroll a fairly large and capable engineering staff that were able to address the problems associated with the design of a disposal site and dealing with the work associated with transporting the tailings. That capability is not typically, as I understand it, present in other States, and other States that we are working with in the UMTRAP project up to this point have not demonstrated an eagerness to take on that responsibility as Utah has.

Mr. MONSON. We're always proud of our capabilities in Utah, but we'd certainly like to see other opportunities develop where we can save money if it's possible, and hopefully improve efficiency at the same time.

Mr. BAUBLITZ. Yes, sir. We still pay the biggest share.

Mr. MONSON. I know that.

Mr. VAUGHAN. You may appreciate—and it is a difficult tradeoff—but one of the things that I commented on particularly with respect to the Uranium Mill Tailings project was an effort to keep that project on the time schedule because the nature of this work, where you have a number of sites in similar vicinities—we've got contractors in place, you know, we're ready to move dirt—the longer you string it out, the longer you carry your overhead, the more the total estimated costs of the projects become.

So frankly, one of our driving factors in keeping the thing on schedule was in fact to not increase the total estimated costs, although you might keep the spending down in any near-term year.

Mr. MONSON. Well, I appreciate that comment and I appreciate your comment, as well. I do want to point out again, though, that as a result I think savings are anticipated to be achieved at both the State and the Federal level; and acknowledging the fact that the Federal level is still contributing the greatest amount of money to the project, it still is something that appears to be a desirable way to proceed, if it's at all possible.

Thank you very much.

Mr. LUNDINE. Mr. Vaughan, I apologize for being late. One problem with the congressional calendar is that everything happens at once, and if you're on five subcommittees it's hard to figure out how to be in five different places at the same time. I do assure you that I'm very interested in your testimony and have had a chance to review it with great interest.

First I'd like to talk with you a moment about the Low-Level Waste Program. Your testimony on page 9 says that it's your objective to develop an effective nationwide low level waste management system by 1988.

Well, it's our objective to do that too, but it's my general impression that we're not seeing much progress out there, outside of South Carolina and Washington and the adjacent States. Can you enlighten me?

Mr. VAUGHAN. As I think you know, Mr. Lundine, the context of the testimony and the Department's objectives have been to assist the States and regions in the development of their compacts, to provide them technical assistance, help survey for sites, look at site disposal criteria. This is not largely a technical problem we're dealing with.

Mr. LUNDINE. I believe that, sir.

Mr. VAUGHAN. This is a simple political problem where the States are chartered by law to reach agreement among themselves in several areas, and it's basically the Federal process that if more than one State decides to do something in concert with another, you need to get a Federal ratification of that.

Mr. LUNDINE. I understand the limited nature of your role; but on the other hand, if things are not proceeding at a reasonable pace, it seems as though we ought to try to make sure that they're stimulated to do so. I think I noted in your testimony that five regional compacts have been——

Mr. VAUGHAN. Five compacts have been submitted, and it will be up to the cognizant congressional committees to help work to get them enacted.

Mr. LUNDINE. By that, do I infer that you believe that five regions are proceeding toward the characterization and implementation of low level waste sites in those five regions?

Mr. VAUGHAN. Yes.

Mr. LUNDINE. That's some good news.

Is there any way that we can try to goad the rest of the States into coming to some kind of a decision in this regard?

Mr. VAUGHAN. Best we can do, I think, within the limits of the law without getting into a level of Federal control that I think is beyond which we are chartered to do, is to continue to provide as much advice and technical knowledge and help as we can, and we are continuing to do that.

Mr. LUNDINE. You are being called upon, at least in those five regions, to provide some degree of technical help with respect to site identification and characterization?

Mr. VAUGHAN. Yes, we are. If you'd like a couple minutes of elaboration, I can have either Mr. Voigt elaborate or, I also have with me Joe Coleman who has been doing most of the work with the States in that area.

Mr. LUNDINE. I'd be interested in that, please.

Mr. VAUGHAN. Mr. Chairman, this is Joseph Coleman, who is a member of my team who deals principally in working with the States with the low level waste compacts.

Mr. COLEMAN. Our program for the last several years has been geared around being a facilitator and providing financial and technical support to States and to regional groups that are trying to satisfy their responsibilities under the Low-Level[2] Act. So in addition to these five regions which have submitted legislation for congressional consent of those particular compacts, there are other States and regions and groups that we have supported to push this whole effort along and try to help them to satisfy their responsibilities in a facilitating way.

I can answer other questions for you. That's in general the approach we've taken in our program.

Mr. LUNDINE. I was only aware of two sites that were acceptable low-level operations at the present, one in South Carolina and one in Washington. Are there others?

Mr. COLEMAN. Yes. There's a third site that takes about 2 percent to 4 percent of the country's low level waste, and that is in Beatty, NV. The other sites in the State of Washington and in South Carolina take about half of the remainder, each.

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[2] Radioactive Waste Policy.

Mr. LUNDINE. What about the other areas? Are they looking at developing sites?

Mr. COLEMAN. Yes. Some States have decided to go it alone, such as the State of Texas. They have established a Low-Level[3] Waste Disposal Authority; they are proceeding and, I believe, have selected a site of which they are now beginning their characterization of that particular site. Another area of the country, the State of California, has joined with the State of Arizona and they are proceeding with the location of a site in the State of California. The five regional areas that have submitted language for consent have proceeded legislatively in each of the States, States that have joined those compacts, to agree as to how they would proceed. Of course, in the Southeast, Barnwell is an existing site; it makes things relatively easy there. The State of Washington in the Northwest already has a site; there, again, it's easy. But in the Rocky Mountain region, which has also submitted compact consent language, the Beatty site would probably be used initially while they search for a new site.

In the Central States and in the Midwest, the siting efforts are somewhat behind these other areas. In the Northeast we sense, in the last year or so, a fragmentation of the compacting efforts there. I think that was referred to earlier by Congressman Roe regarding the Pennsylvania location for a site for the surrounding or adjacent States. The State of New York, at the present time, I believe, has decided to go it alone and perhaps join later with other States, and there's some fragmentation also in the New England area.

Mr. LUNDINE. So you're relatively well satisfied that we're making progress toward that 1988 goal?

Mr. COLEMAN. Yes, I think that we are making progress, but I believe that the actions by the States and the educational process, the ability of the State legislatures to understand the problem and decide what to do about it has caused, perhaps, a couple of years' delay in the progress that we had expected in our program.

Mr. LUNDINE. OK. That's some surprisingly pleasant news for me, and I'd like to turn to another subject—I don't mean to be parochial—but of also good news.

I am pleased to note the progress you are making at West Valley. I think it's going to be one of the greatest success stories in terms of nuclear waste management that this country has seen. I had the opportunity last summer to tour the facility—I must say, before we got the project started it seemed like I toured it twice a year or more often, but since then and since it's no longer in my congressional district, I was pleased to see the progress, that the project seemed ahead of schedule.

I note in your testimony, again, that you refer to the glassification process being slated for 1988. Is it possible, with the level of budgetary requests that you've made, that that might be advanced?

Mr. VAUGHAN. I'm going to let Bill Voigt respond to that question.

Mr. VOIGT. Mr. Chairman, in fact we have already advanced the schedule over what we had earlier contemplated for West Valley.

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[3] Radioactive.

Although the sludge—the radioactive operation of the sludge—is still scheduled for 1988, we've advanced the supernate, which is a preamble to that, to 1986, which is 1 year earlier than what we had scheduled for last year, in last year's presentation.

In addition to that, of course, brought our first nonradioactive glass log on December 27; that was about 6 months ahead of schedule, and we're currently estimating that the total estimated costs of the project will be decreased on the order of $30 million. So everything is looking good, so far as the project is concerned.

Mr. LUNDINE. You have not run into unanticipated problems; is that correct?

Mr. VOIGT. I think that's a fair statement, Mr. Chairman. The only problem we did encounter, although it's currently stable, is the migration of kerosene and the plutonium that went along with that in some of the—in the NRC-licensed disposal site. But we have pumped about 600 gallons of that kerosene and it appears right now that it is in a stable condition, but we don't know how long it's going to be stable.

Mr. LUNDINE. I understand that you have a film presentation of limited length. Would you be able to show us that now?

Mr. VAUGHAN. It's about 6 minutes long and we would be more than pleased. The chairman wanted to wait until you came to see if you wanted to see it, since——

Mr. LUNDINE. I really appreciate that. I get my excitement that way. [Laughter.]

Mr. VAUGHAN. You're in charge, Mr. Lundine, and we'd be more than pleased to bring you up to speed.

Mr. LUNDINE. Unless there's any objection of subcommittee members, I think we'd like to see the film now.

[Videotape presentation made.]

Mr. VAUGHAN. I might say, Mr. Lundine, that I've known Mr. Boswell, who is the general manager there, for over 20 years professionally, and he's a very capable person to make that project work. I would also like to add that we've been very pleased with the response of the people of the State of New York and the media. We have tried to keep a very open information flow, responsible public relations; as you know, we hold an open house every year for the public to come in and see what's going on, and I think that's been of mutual benefit, both to the project and to the people of your State. It does show what we can do when we set our minds to do it.

Mr. LUNDINE. I agree completely, and I think this is one project on which people who have widely differing views about other nuclear issues can unite. And I think you're doing an excellent job, and the contractor is as well.

Are there any other questions for Mr. Vaughan?

[No response.]

If not, we're going to adjourn briefly. We have two votes, I believe, on the House floor, and we will take Mr. Rusche's testimony as soon as those votes can be completed. The subcommittee will stand in adjournment for approximately 15 minutes.

[Recess taken.]

Mr. LUNDINE. The subcommittee will come to order.

Our next witness is Ben Rusche, the Director of the Office of Civilian Radioactive Waste Management.

We welcome you back before this subcommittee, Ben.

Mr. Rusche will be describing the Department's nuclear waste fund activities, which are by any reckoning, the subject of a great deal of discussion.

We have your written testimony before us; it will be included in the record in its entirety. You may summarize or proceed as you wish.

STATEMENT OF BEN C. RUSCHE, DIRECTOR, OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT, U.S. DEPARTMENT OF ENERGY

Mr. Rusche. Thank you, Mr. Chairman, members of the subcommittee.

I am pleased to appear before you today to discuss the Department of Energy's fiscal year 1986 civilian radioactive waste management budget and programs. The fiscal year-1986 budget represents the second budget formulated by the Office of Civilian Radioactive Waste Management since passage of the Nuclear Waste Policy Act of 1982, and it is my first opportunity as director of the program to appear before you. The budget presents an integrated picture of programmatic activities for a total waste management system consistent with my discussions at the time of my confirmation.

If I might inject an aside at the beginning, it's a pleasure to have the opportunity to testify before you, Mr. Chairman, and reflect on some activities that we were involved in in another existence, and even to see them memorialized on film today. And I think that your effort in those days was a major contribution to moving ahead in that project.

The Nuclear Waste Policy Act of 1982 mandates a comprehensive set of Federal activities directed by DOE and designed to begin operating a Federal waste management and disposal system capable of accepting spent nuclear fuel and high-level radioactive waste for permanent disposal by 1998. DOE's commitment to begin operating this system and receiving spent fuel by 1998 is unequivocal.

It is clear that within an overall waste management system, transportation, handling, packaging, storage, and disposal are all integrated parts.

In the overall system, a monitored retrievable storage option, which the act requires us to consider, and transportation are major subsystems along with geologic repositories. The importance of integration of these systems is reflected in the fiscal year 1986 budget request.

The principal source of funds for the Nuclear Waste Program is the Nuclear Waste Fund, financed by fees collected from owners and generators of spent nuclear fuel and high-level radioactive waste. To have such a revenue stream, rather than operating under appropriated tax dollars, makes it imperative that the program be managed like a business. The requirements, as well as the opportunity, for fiduciary responsibility and accountability are almost unprecedented in the Federal Government. To assist the Department in this regard, we have retained Main Hurdman, an international public accounting firm, to provide professional auditing services related to revenues and expenditures of the Office of Civilian Radioactive Waste Management, in addition to the internal audit procedures and those applied on a routine basis—and in this case, an accelerated basis—by the GAO.

Research and development activities of a generic nature are not eligible for financing under the Nuclear Waste Fund, including research and cooperative agreements on spent fuel and research on alternative disposal concepts. These are funded under the energy supply research and development appropriation in a program entitled Civilian Radioactive Waste Research and Development.

The fiscal year 1986 budget request for budget authority funded by the Nuclear Waste Fund is $571.5 million. You will recall that under the act, we are required to project a triennial, or 3-year, budget; and I will just note that for fiscal year 1987 we project $836 million, and for fiscal year 1988, $686 million.

The fiscal year 1986 departmental request for civilian radioactive waste R&D is $23.4 million.

Let me very briefly touch on some highlights of items in the program and then take questions that you might have.

Under the Waste Fund Program—I'm going to mention only the 1986 request, and the details are in the document—the fiscal year 1986 budget request for activities associated with the first repository is $436.8 million. The funding for the first repository is mainly required for an extensive site characterization, drilling, and testing, startup exploratory shafts, construction, and intensive engineering tests and analyses to support waste package and repository designs.

For the second repository, the fiscal year 1986 budget request for activities associated with this activity is $43.9 million. The decision points for the second repository program follow by about 5 years those for the first repository. The fiscal year 1986 request supports the Presidential site recommendation for the second repository, targeted for 1997. Currently, the Department is conducting studies in crystalline rock in 3 regions—the North Central, the Northeastern, and Southeastern regions—to identify potentially acceptable sites for a second repository. Other studies of sedimentary rock are being conducted to determine if those media may contain potentially acceptable sites also.

For our monitored retrievable storage [MRS], the fiscal year 1986 budget request is $12.9 million. We believe an MRS facility should be considered as an integral part of the total waste management system, and we consider it an essential element in achieving the overall system objectives.

DOE is studying the need for and feasibility of MRS facilities and is preparing a proposal for the construction of one or more MRS facilities, as the act requires us to. The fiscal year 1986 budget request assumes that Congress will authorize the Department to proceed with activities that are critical for deployment of an integrated MRS facility capable of meeting waste system needs and providing assurance of the Federal Government's ability to accept spent fuel and high-level waste. The evaluation as to the need for and feasibility of MRS is critical to DOE's waste management system activities. Evaluation will form the basis for specific plans and recommendations that are to be included in the proposal. All activities will be proposed to enable completion and operation of the facilities as soon as practicable, and on a parallel basis with repository development.

You will recall that under the act we are obligated to report to Congress by June 1985 what our status is in that activity, and we hope indeed to have such a report later in the spring, and that we will have a more definitive proposal later in the year.

For the out years we have not made definitive requests but have taken typical values in the budget in order to not prejudge the action of Congress on the proposal that we will be making.

In transportation and systems integration activities, which have taken on a great deal more significance and urgency as we have looked at the matter over the last 6 or 8 months, the fiscal year 1986 request is $22.6 million. The funding request for fiscal year 1986 provides the support required to develop adequate transportation and integrated systems for the shipping and management of nuclear waste among the various components of the disposal system.

For program management and support, the fiscal year 1986 request is $55.2 million. The fiscal year 1986 request provides for a total of 292 full-time equivalents for positions at headquarters and in the operations offices to manage funding, site investigation, technology development, and institutional liaison associated with the technical management of the repository, MRS, supporting programs, and the management of the Nuclear Waste Fund.

Let me take just a moment on the Civilian Radioactive Waste R&D Program, which is funded with appropriated dollars.

The request for fiscal year 1986 for this program is $23.4 million. There are 3 or 4 categories of activities that I would like to call to your attention especially.

Spent fuel storage R&D is a program to encourage and expedite the most efficient use of existing storage facilities and the addition of new, licensed capacity in a timely fashion. The fiscal year 1986 request to support these activities is $8.9 million.

In accordance with section 222 of the act, we will continue alternative disposal concept studies in research and development and investigations of alternative means and technologies for permanent disposal of high-level waste. The fiscal year 1986 request for these activities is $12.5 million, and almost all of this goes to activities in a joint international program looking at the subseabed as a potential possible site for high-level waste disposal.

In generic methods and supporting studies, we conduct 3 main activities. We have international program support of a generic nature, special technical reviews, and general waste management studies. The thrust of these efforts is to assure adequate international cooperation, provide an independent assessment of the technical adequacy of the program, and evaluate potential alternatives which could improve the cost, schedule, or technical aspects of the Civilian Radioactive Waste R&D Programs. We propose in the fiscal year 1986 budget $1.7 million for these activities.

And then finally, for program direction in the R&D effort, we request $325,000 for program direction. At this level, 5 full-time equivalents will be funded to manage the R&D programs.

In summary, the fiscal year 1986 request for spending authority under the Nuclear Waste Fund and for appropriations under the civilian radioactive waste R&D budget are designed to carry out an integrated waste management program in an efficient and effective manner, and to achieve the 1998 mandate of the Nuclear Waste Policy Act: that is, to have in place a comprehensive and functional waste disposal system to begin receiving spent fuel in 1998.

Mr. Chairman, I think I'll conclude my remarks at this point and invite questions on the testimony or any other questions that you or members of the committee might have.

[The prepared statement of Mr. Rusche follows:]

PREPARED STATEMENT BY BEN C. RUSCHE, DIRECTOR, OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT, U.S. DEPARTMENT OF ENERGY

Madam Chairman and Members of the Subcommittee:

I am pleased to appear before you today to discuss the Department of Energy's (DOE's) Fiscal Year 1986 Civilian Radioactive Waste Management budget and programs. The FY 1986 budget represents the second budget formulated by the Office of Civilian Radioactive Waste Management since passage of the Nuclear Waste Policy Act of 1982 and presents an integrated picture of programmatic activities for a total waste management system.

The Nuclear Waste Policy Act of 1982 mandates a comprehensive set of Federal activities directed by DOE and designed to begin operating a Federal waste management and disposal system capable of accepting spent nuclear fuel and high-level radioactive waste for permanent disposal by 1998. DOE's commitment to begin operating this system and receiving spent fuel by 1998 is unequivocal. In carrying out the requirements of the Act, this will provide a permanent solution to this important national problem and will allow utilities and their ratepayers assurance in planning for such disposal.

The Act confirms DOE's earlier decision that deep, geologic repositories, can safely and permanently isolate high-level waste from the public and the environment. It is clear, however, that within an overall waste management system, transportation, handling, packaging, storage and disposal are integral parts.

In the overall system, a Monitored Retrievable Storage (MRS) option, which the Act requires us to consider, and transportation are major subsystems along with geologic repositories. The importance of integration of these systems is reflected in the FY 1986 budget request which includes, for the first time, a separate budget line item for transportation and system integration.

The Nuclear Waste Policy Act created the Nuclear Waste Fund which is financed by fees collected from owners and generators of spent fuel and high-level waste. The Nuclear Waste Fund creates the necessity for managing the program like a business. The requirements, as well as the opportunity, for fuduciary responsibility and accountability are almost unprecedented in the Federal Government for such a major development and construction program. And I am committed to conducting the program within our revenue.

Research and development activities not eligible for financing under the Nuclear Waste Fund, including research and cooperative agreements on spent fuel and research on alternative disposal concepts, are funded under the Energy Supply Research and Development Appropriation in a program entitled Civilian Radioactive Waste Research and Development (R&D).

The FY 1986 budget request for budget authority funded by the Nuclear Waste Fund is $571.460 million.[1/] This budget request is summarized in Table 1. The FY 1986 Departmental budget request for Civilian Radioactive Waste R&D is $23.4 million. This budget is summarized in Table 2.

[1/] The Nuclear Waste Policy Act requires the Secretary to submit a triennial budget for the Nuclear Waste Fund. The discussion of specific activities presented in the Nuclear Waste Fund Program gives estimates for FY 1987 and FY 1988. The estimates for the total Waste Fund Program are: FY 1987 - $836.1 million; FY 1988 - $685.5 million.

TABLE 1

FY 1986 CONGRESSIONAL BUDGET
NUCLEAR WASTE FUND
(Budget Authority in Thousands)

	FY 1984 Approp.	FY 1985 Approp.	FY 1986 Request
NUCLEAR WASTE FUND			
Repository Deployment			
o First Repository	$246,560	$244,400	$436,800
o Second Repository	16,270	24,700	43,900
Monitored Retrievable Storage	12,000	8,500	12,900
Transportation and Systems Integration	3,900	2,400	22,625
Program Management and Technical Support	36,191	44,369	55,235
Debt Service (Interest)a/	4,700	3,300	----
TOTAL	319,621	327,669	571,460
Projected Receipts			
o One mill/KWh fee	329,539	350,300	401,100
o One-time Fee	----	770,000	----
TOTAL	329,539	1,120,300	401,100
Interest Income	----	21,798	86,640
Staffing Full-Time Equivalents (FTE's)	172	266	292

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a/ DOE anticipates collection of approximately $770,000,000 from utilities who plan to exercise the lump sum option for spent fuel discharged prior to April 7, 1983. After receipt, DOE will repay the appropriated debt of $258,443,270.

TABLE 2

FY 1986 CONGRESSIONAL BUDGET
ENERGY SUPPLY RESEARCH AND DEVELOPMENT ACTIVITIES
(Budget Authority In Thousands)

	FY 1984 Approp.	FY 1985 Approp.	FY 1986 Request
CIVILIAN RADIOACTIVE WASTE R&D			
Spent Fuel Storage Development	$ 5,000	$12,625	$ 8,900
Alternative Disposal Concepts	7,500	11,475	12,500
Generic Methods and Supporting Studies	1,550	2,021	1,650
Program Direction	130	266	325
TOTAL	14,180	26,387a/	23,375
Staffing FTE's	2	5	5

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a/ Reflects reductions as follows: General Reduction, $660,000; ADP Reduction, $550,000; and Rescission, $43,000.

Before discussing the details of the FY 1986 budget request, I would like to discuss briefly the strategy of the program and summarize major accomplishments since enactment of the Nuclear Waste Policy Act as well as the status of the program.

PROGRAM STRATEGY

The major goal upon which the program strategy is based is that spent nuclear fuel and high-level nuclear waste must be disposed of in a manner that adequately protects public health and safety and the environment for this and future generations. To do so, a comprehensive waste management system must be implemented.

The Nuclear Waste Policy Act of 1982 established the method of disposal, a schedule, technical processes, institutional processes and a funding mechanism to ensure successful implementation of the Act.

There are numerous intermediate dates and key milestones laid out in the Act of which I am aware the Subcommittee and others have voiced concern. Some observers may, in fact, look at our efforts to date and conclude that we have slipped schedules to the extent that the 1998 commitment may not be met. On the other hand, some believe we are driven only by milestones engraved in the Act, and that we are not committed to full and open participation by affected and interested parties as called for in the Act.

As I stated earlier, our commitment to begin receiving spent fuel in 1998 is unequivocal. In meeting that commitment, I wish to emphasize that we are committed to "success" -- not just "timely success."

Our success in meeting the milestones on tne schedule laid out in the Act has not been as high as some would like. But we recognize that our best chance for accomplishing the mandate of the Act is to do well what is required. For this reason, some of the milestones in the early decisional stages are indeed far more important than later ones and, therefore, worth investing adequate time and resources to assure a quality result. The interests of States, Indian tribes and other affected and interested parties must be considered fully.

So while we have taken more time to accomplish many of the early milestones called for the Act, we believe that the quality of the results to date indicate now and will prove later to be an appropriate expenditure of time.

Keeping the importance of the interactive process in mind, our program strategy is to optimize the total waste system to the extent practical in terms of safety, environmental protection, cost-effectiveness and schedule, taking into account transportation, packaging, storage, system reliability, overall costs and the logistics and associated interface problems.

The overall strategy of the program, therefore, is to:

o carry out a comprehensive set of Federal and Federal-State interactive activities to site, design, construct and operate the Nation's first permanent nuclear waste repository;

o proceed with activities for proposing deployment of an MRS facility as an intermediate packaging and handling facility;

o develop a transportation system to assure that a safe, environmentally acceptable and cost-effective transportation system is in place by 1998;

o support those subsystems -- such as, licensed cost-effective technologies for at-reactor storage -- necessary for development of the total waste management system; and,

o ensure fiduciary responsibility in the execution and management of technically sound, cost-effective programs.

MAJOR ACCOMPLISHMENTS AND STATUS OF PROGRAM

Potentially Acceptable Sites

When the Act became law in January 1983, DOE had under study nine sites for consideration for the first repository. These sites emerged from extensive technical, socioeconomic, environmental and institutional analyses that had been undertaken by DOE during the past decade. In February 1983, those sites, including two in Utah, one in Washington, one in Nevada, two in Texas, two in Mississippi and one in Louisiana, were formally identified as being potentially acceptable sites for the first repository and notifications were made to the Governors of those States, the State legislatures and the tribal councils of affected Indian tribes of the potentially acceptable sites within these States.

Nuclear Waste Fund

In April 1983, DOE adopted a fee of one mill (one-tenth of a cent) per kilowatt hour charged to utilities for all nuclear-generated electricity beginning April 7, 1983, as specified in the Act. Revenues collected by DOE through January 1985, total approximately $553.6 million.

In addition to spent fuel generated since April 7, 1983, spent fuel or high-level waste generated prior to that date is subject to a fee equivalent to an average charge of one mill per kilowatt hour. Utilities have until June 1985 to decide on one of three payment options. The estimated revenue from the one-time fee for this spent fuel is approximately $2.3 billion. While it is not possible to know for certain when these revenues will be available to the Fund, DOE undertook three separate surveys to determine utilities' intent in paying this one-time fee. About 50 percent responded that they would pay approximately $770 million by June 1985 in order to save interest charges which would accrue under the payment options.

DOE has issued three annual fee adequacy evaluation reports, the latest of which was submitted to Congress in mid-February. The latest report -- Nuclear Waste Fund Fee Adequacy: An Assessment -- indicates that no adjustment of the one-mill per kilowatt fee is necessary at this time.

Disposal Contracts

By June 1983, disposal contracts were signed with all then existing owners and generators of spent fuel and high-level waste. Since then, additional contracts have been signed covering new nuclear power plants which have come on line. As part of the contract, DOE is currently developing a waste acceptance schedule.

Annual Report to Congress

In February 1984, DOE issued the first Annual Report to Congress. The second Annual Report is in the final stages of preparation.

Mission Plan

In May 1984, DOE issued a draft Mission Plan for public review and comment. The purpose of the Mission Plan, as prescribed in the Act, is to provide an information base sufficient to permit informed decisions to be made in carrying out the repository and other programs mandated by the Act. An updated Mission Plan is currently in preparation and we expect to submit it to Congress in May 1985.

Repository Siting Guidelines

On December 6, 1984, and after extensive State and public review and comment, and after concurrence by the Nuclear Regulatory Commission, DOE issued General Guidelines for the Recommendation of Sites for the Nuclear Waste Repositories.

Repositories Development

On December 20, 1984, DOE issued for ninety days public review and comment draft Environmental Assessments proposing five sites for nomination as suitable for site characterization for the first repository and proposing three of those sites as preferred for recommendation to the President for site characterization. The five sites proposed for nomination for site characterization are, in alphabetical order by State:

- Richton Dome in Mississippi;
- Yucca Mountain in Nevada;
- Deaf Smith in Texas;
- Davis Canyon in Utah; and,
- Hanford in Washington.

The three sites proposed for recommendation for site characterization are:

- Yucca Mountain,
- Deaf Smith, and
- Hanford.

Since issuance of the nine draft Environmental Assessments, DOE has held some 50 briefings in the affected States to facilitate the review of the documents and is now in the process of conducting eighteen Public Hearings to receive testimony on the documents.

After consideration of oral and written comments, and consultation with affected States and Indian tribes, DOE will prepare final Environmental Assessments. The Secretary of Energy will formally nominate at least five sites as suitable for site characterization and each nomination will be accompanied by a final environmental assessment. He will then recommend three of the nominated sites to the President for site characterization as candidate sites for the first repository. Site characterization will occur only at the sites recommended to and approved by the President. This recommendation is expected to occur in late summer 1985.

After the three sites have been approved by the President, site characterization is expected to begin in FY 1986. This will involve an intensive site evaluation program including in situ testing at the bottom of deep exploratory shafts. Shaft construction at the three sites will take approximately two years with in situ tests planned for FY 1987 through FY 1990. Currently, DOE plans to construct two shafts at each site.

After four-to-five years of site characterization are completed, DOE will again evaluate each site and recommend one site to the President for the first repository. The President will then recommend one site to Congress.

When the President recommends the site to Congress, which is estimated to be in early 1991, the host State may issue a notice of disapproval that can be overridden only by a resolution of both Houses of the U.S. Congress. If the notice of disapproval is not overridden, the President must submit another repository site recommendation to Congress within 12 months. If no notice of disapproval is submitted, or if the notice of disapproval is overridden, then, as prescribed by the Act, the site designation is effective and DOE will proceed to file an application with the Nuclear Regulatory Commission to obtain a construction authorization for a repository at that site.

The process for selecting the second repository is the same winnowing process as described above for the first repository and lags the first repository schedule by about five years. DOE may consider sites identified as potentially acceptable but not nominated for the first repository, sites found potentially acceptable from rock formations not previously studied in the first repository selection process, and sites characterized but not chosen for the first repository site.

Monitored Retrievable Storage

The need for and feasibility of Monitored Retrievable Storage (MRS) facilities has been studied. Storage concepts have been selected and designs developed. A proposal for construction of one or more MRS facilities is now being completed for submittal to the Congress.

Defense High-Level Waste

In August 1984, DOE issued a draft evaluation of the use of disposal capacity at the civilian repositories for disposal of high-level waste resulting from defense activities. Based on the draft evaluation, the only factor that results in a significant advantage for either option -- disposing of commercial high-level waste and defense high-level waste in the same repositories or in separate repositories -- is cost efficiency. DOE has completed its final evaluation and has concluded that due to the clear cost advantage to be gained by disposing of defense high-level wastes in a combined commercial and defense repository, combined repositories are the appropriate option. This recommendation will be made to the President very shortly. The Act clearly states that costs resulting from permanent disposal of defense high-level waste shall be paid by the Federal Government into the Nuclear Waste Fund.

Alternative Approaches to Managing and Financing Waste Management

The Act requires the Secretary to undertake a study with respect to alternative approaches to managing the construction and operation of all civilian radioactive waste management facilities, including the feasibility of establishing a private corporation.

In December 1984, the 13 person advisory panel -- Advisory Panel on Alternative Means of Managing and Financing -- appointed by the Secretary, completed a year's study and submitted a report to the Secretary. The principal findings of the panel are that the funding mechanism is adequate to achieve program success and that consideration should be given to establishing a Federally-chartered corporation to carry out the management of repository construction and operation. The report is currently being reviewed within DOE and will be submitted to the Congress within the next few weeks.

Research and Development Activities

The Civilian Radioactive Waste R&D program is comprised of a series of cooperative agreement activities that are designed to advance the research objectives of the Nuclear Waste Policy Act. Some of the R&D programs were in progress prior to passage of the Act and others are new initiatives. All of these activities have now been integrated to avoid duplication and to complement the total waste management system.

Under the Act, DOE must budget for spent fuel storage development, alternative methods of disposal and generic repository research, development and demonstration activities. These activities are not eligible for funding under the Nuclear Waste Fund.

In February 1984, DOE signed a contract with Nuclear Fuel Services, Inc. to demonstrate, under a cost-sharing arrangement, cask transportation and dry storage. And in March 1984, DOE entered into cooperative agreements with the Virginia Electric and Power Company (VEPCO), Richmond, Virginia, and the Carolina Power and Light Company (CP&L), Raleigh, North Carolina, to participate in a demonstration of dry storage of spent fuel.

DOE has also provided rod consolidation equipment to the Tennessee Valley Authority (TVA) for a small scale demonstration. Another cooperative agreement is currently being negotiated with Northeast Utilities Company of Hartford, Connecticut, to demonstrate rod consolidation on a large scale.

DOE is conducting and participating in international research and development including investigations of alternative means and technologies for the permanent disposal of high-level waste. The subseabed disposal concept is the only alternative currently being studied in detail. By 1990, determination will be made of the technical, engineering, environmental and institutional feasibility of disposing of nuclear waste in the stable geologic formations of the deep ocean floor. In the meantime, DOE is cooperating with other nations in their assessments of subseabed disposal. International coordination is conducted through a Seabed Working Group of the Nuclear Energy Agency of the Organization for Economic Cooperation and Development.

The Act states that it is the policy of the United States to cooperate with and provide technical assistance to nonnuclear weapon states in the field of spent fuel storage and disposal. DOE and the Nuclear Regulatory Commission published a Joint Notice in the Federal Register in March 1983 and reissued the Joint Notice in April 1984 to solicit expressions of interest. To date, the Department of State has formally received responses from Brazil, CCNAA (Taiwan), Egypt, Mexico, Netherlands and the Republic of Korea. Several other nations are expected to make similar responses in the nearterm.

Project Decision Schedule

As called for in the Act, a Project Decision Schedule has been prepared and is currently being reviewed by affected Federal Agencies. This schedule is intended to lay out the optimum way to attain the operation of the waste management system and, therefore, includes a description and a sequence of deadlines for all Federal agencies required to take action.

International Activities

As a further step in program integration, we have completed an evaluation of international aspects of the waste program and have developed a comprehensive strategic plan for international cooperation.

I would like now to highlight some of the major elements of the FY 1986 program and budget request. The discussion is divided into two parts which coincides with the two separate budgets managed by the Office of Civilian Radioactive Waste Management: The Nuclear Waste Fund Program; and the Civilian Radioactive Waste Research and Development Program.

THE NUCLEAR WASTE FUND PROGRAM

Revenue Sources

To finance the nuclear waste disposal program, the Nuclear Waste Policy Act of 1982 established the Nuclear Waste Fund. The Fund receives all the revenue the Department collects from generators of civilian spent fuel and high-level nuclear waste.

The main source of revenue for the Fund is the one mill per kilowatt hour fee charged for all electricity generated beginning April 7, 1983, by the commercial nuclear power reactors. High-level radioactive waste and spent fuel generated prior to April 7, 1983, is subject to a one-time fee that is equivalent to an average charge of one mill per kilowatt hour. The utilities have three payment options and must decide by June 1985 as to which payment option they will select.

As mentioned earlier, some utilities have indicated they may choose the payment option whereby payment would be made as a one-time fee by June 1985. This could result in payments of approximately $770 million. If these monies are received in 1985, DOE could repay the debt transferred to the Fund since enactment of the Nuclear Waste Policy Act. This debt is approximately $258 million.

It should be noted, however, that the intent expressed by some utilities to pay the one-time fee by June 1985 is not binding at this time. However, all utilities must choose their payment option prior to June 1985. If the entire one-time fee were paid by June 1985, it is estimated to be about $2.3 billion. For that which is not paid by June 1985, the amount will increase as interest is applied for utilities which choose to defer payment.

If the President accepts DOE's recommendation to dispose of defense waste in a commercial repository, the Federal Government would pay an equivalent fee to that paid by utilities. This use of the repository would generate additional revenue for the Fund. The amount of the additional revenue is unknown at this time and is not included in our revenue estimates. We are developing a Memorandum of Understanding with DOE's Office of Defense Programs to be used as the vehicle in determining an equitable cost-sharing methodology.

Other fees for DOE-owned fuel which is not defense related will also be deposited into the Nuclear Waste Fund. Currently, DOE is surveying all its programs to establish how much fuel will be emplaced in a repository and how much DOE owes to the Fund. These additional revenues are also unknown at this time and are not included in the revenue estimates.

The revenue projections based on the one mill per kilowatt hour fee are shown in Table 3.

TABLE 3

NUCLEAR WASTE FUND REVENUE PROJECTIONSa/
(In Thousands)

FY 1983	FY 1984	FY 1985	FY 1986	FY 1987	FY 1988
$73,580 (actual)	$329,539 (actual)	$1,120,300	$401,100	$454,300	$504,300

a/ Includes one-time fee payments in FY 1985 and FY 1988.

Repository Program

(1) First Repository:

The FY 1986 budget request for activities associated with the first repository is $436.8 million. The FY 1987 estimate is $641.7 million; and the FY 1988 estimate is $486.7 million.

The funding for the first repository is mainly required for extensive site characterization drilling and testing, start of exploratory shaft construction and intensive engineering tests and analyses to support waste package and repository designs.

The major programmatic milestones associated with the schedule for the first repository are as follows:

Milestone	Calendar Year
o Nominate at least five sites and recommend three candidate sites to President for characterization	1985
o Issue Site Characterization Plans (SCP) for	

the three candidate sites	1985-1986
o Begin construction of first exploratory shaft	1986
o Issue Final Environmental Impact Statement	1990
o Recommend first repository site to President	1990
o Recommend first repository site to Congress	1991
o Submit construction application to NRC	1991
o Receive from NRC Construction Authorization	1993-1994
o Begin Phase I Operations	1998

The FY 1986 activities included in the $436.8 million are as follows:

o Begin site characterization activities at each of the three candidate sites. Conduct tests and analyze data to resolve issues for waste isolation most pertinent for the site or sites being investigated. Conduct drilling and testing of surface-based boreholes, logging, geologic field studies, geophysical surveys, long-term monitoring in wells to resolve site suitability issues and to incorporate into updated Site Characterization Plans (SCP). Analyze site and regional hydrology in more detail using data obtained from tests of hydrologic boreholes along assumed flow paths. Continue site environmental characterization and socioeconomic evaluations. ($122 million)

o Begin construction of exploratory shafts in basalt and tuff. (Construction of exploratory shaft in salt to begin the following year.) Two shafts are planned for each site. Two shafts are required to provide an access to the repository horizon for site characterization and to meet ventilation, safety and emergency egress requirements. ($106.8 million)

o Conduct site-specific engineering tests at the three candidate sites including evaluations of rock mechanics, sealing concepts, shaft and tunnel excavation methods and waste emplacement alternative methods. Conduct repository conceptual design studies. ($59.8 million)

o Conduct regulatory and institutional interface. Issue initial basalt and tuff SCP's. Coordinate activities with the NRC, the U.S. Geological Survey (USGS), the Environmental Protection Agency (EPA) and appropriate State agencies and Indian tribes. These funds also provide the resources to conduct the program under an open information policy and afford the State and local governments and Indian tribes the opportunity to participate in the decisionmaking process. Provide financial assistance to affected States and Indian tribes. These funds would be used to allow the States and Indian tribes to study, determine, comment on, and make recommendations regarding possible health, safety, environmental, social and economic impacts of a repository. Conduct public meetings, public hearings, tours and briefings; prepare publications; etc. ($41.9 million)

o Continue waste package design and development for the three candidate sites. Continue advanced conceptual design of the waste package. Conduct site-specific geochemistry and materials interaction studies. Corrosion analysis and waste package welding will also be studied. Continue studies of copper and copper alloys in an effort to evaluate the suitability of this material for canisters at tuff and basalt sites. At the close of FY 1986, these studies will provide sufficient data for the Department to decide on the viability of copper as a potential waste package material. ($38.9 million)

o Develop representative models for the performance of a repository site. Analyze groundwater flow systems to assess repository performance. Continue data base management, documentation and implementation of system engineering plans and other system engineering analyses. ($20 million)

o Continue to operate and maintain test facilities to conduct studies of rock mechanics and the effects of heat on rock and canister materials. Continue to support cooperative studies with foreign governments, especially at the Asse salt mine in West Germany. Access to the Avery Island salt mine in Louisiana will be maintained for possible study of salt and engineered barrier materials interaction. ($3.9 million)

o Complete land acquisition for construction of exploratory shafts in salt. ($12.2 million)

o Provide support for project management in developing and updating project management plans, operation of project cost and schedule control systems, management of subcontractors, operation of a quality assurance program, etc. ($31.3 million)

The FY 1987 and FY 1988 estimates of $641.7 million and $486.7 million, respectively, will support full site characterization at the three recommended repository sites and shaft procurement and construction at those sites as well as waste package and repository development and design efforts.

(2) Second Repository:

The FY 1986 budget request for activities associated with the second repository is $43.9 million. The FY 1987 estimate is $97.5 million; and the FY 1988 estimate is $102.1 million.

The decision points for the second repository program are spaced about five years from those for the first repository. The FY 1986 request supports the Presidential site recommendation for the second repository which is targeted for 1997.

Currently, the Department is conducting studies in crystalline rock in three regions -- the North Central, the Northeastern and the Southeastern regions -- to identify potentially acceptable sites for a second repository. Other studies of sedimentary rock bodies are being conducted to determine if those media may contain potentially acceptable sites. The major milestones leading to the site recommendation and license application decisions for the second repository are as follows:

Milestones	Calendar Year
o Issue revised draft regional characterization reports	12/84
o Issue final region to area screening methodology	4/85
o Issue final regional characterization reports	7/85

o Issue draft crystalline rock area recommendation report	11/85
o Issue draft crystalline rock area characterization plan	3/86
o Issue final crystalline rock area recommendation report	5/86
o Issue final area characterization plan and initiate crystalline rock area phase field investigations	9/86
o Recommend sites to President for characterization	1991
o President recommends repository site to Congress	1997
o Submit license application to NRC	1997
o Receive construction authorization from NRC	1999

The FY 1986 activities included in $43.9 million are as follows:

o Complete area recommendation report and area characterization plan. Collect and analyze regional-level data to assist in preparation of the Area Characterization Plan. Monitor progress of other projects, including those in other countries, in obtaining geologic, hydrologic, environmental and socioeconomic data. Prepare for field investigations and more detailed, specific geologic, environmental, transportation and socioeconomic studies. ($21.8 million)

o Conduct institutional activities, including workshops, meetings, public information and education activities. Continue

Federal/State assistance through the issuance of grants. ($6.4 million)

o Establish area phase decision methodology and expand technical data base system. Issue decision methodology to States. Conduct preliminary performance assessment on the initial set of candidate areas to assist in area characterization and screening. ($3.7 million)

o Conduct initial repository conceptual design studies and continue engineering support for area-phase data collection. ($1.5 million)

o Complete current testing in the Stripa mine project. Continue tests at Grimsel facility and the Canadian Underground Research Laboratory (URL). Participate in URL construction activities and the Atikokan Flow Systems Study. Continue tests at the Colorado School of Mines and initiate field operations at Climax. ($3.7 million)

o Initiate efforts for land access for Area Phase Field Studies. ($1 million)

o Prepare guidance on waste package design and performance characteristics to assist the area characterization activities. ($1.1 million)

o Provide support for project management, including implementation of cost/schedule control systems, developing and maintaining a quality assurance program and for overall planning, coordination and management. ($4.7 million)

The FY 1987 and FY 1988 estimates of $97.5 million and $102 million, respectively, will support field investigations, initial activities to support preparation of environmental assessments and site characterization plans, grants to affected States and Indian tribes, and State and public interactions including workshops and public hearings.

Monitored Retrievable Storage

The FY 1986 budget request for MRS is $12.9 million. The FY 1987 estimate is $13.6 million; and the FY 1988 estimate is $18.7 million.

We believe an MRS facility should be an integral part of the total waste management system and we consider it an essential element in achieving overall system objectives.

DOE has studied the need for and feasibility of MRS facilities and is preparing a proposal for the construction of one or more MRS facilities. The FY 1986 budget request assumes Congress will authorize the Department to proceed with activities that are critical for deployment of an integrated MRS facility capable of meeting waste system needs and providing assurance of the Federal Government's ability to accept spent fuel and high-level waste.

The evaluation as to the need for and feasibility of MRS is critical to DOE's waste management system activities. The evaluation will form the basis for the specific plans and recommendations that are to be included in the proposal. The proposal will be accompanied by an environmental assessment, will include detailed designs and siting information, specifications and cost estimates to support congressional authorization. Once authorized, DOE will proceed with siting, design, compliance with the National Environmental Policy Act (NEPA) and licensing activities. All activities will be proposed to enable completion and operation of facilities as soon as practicable and on a parallel basis with repository development.

Major activities included in the FY 1986 budget request of $12.9 million are as follows:

o Proceed with environmental data gathering and analysis at potential sites. Initiate scoping for the draft Environmental Impact Statement. ($4.3 million)

o Complete activities initiated in FY 1985 for procurement of a design/construction contractor and award contract. Further refine design and support systems needs. Initiate testing and evaluation of systems components and procedures to verify the design of critical elements of MRS facilities and provide data to support facility licensing. Implement licensing approach; conduct analyses and prepare topical reports on potential licensing issues. ($6.5 million)

o Conduct systems support activities to include establishing waste acceptance criteria, definition of shipping cask logistics requirements, monitoring storage needs projections, maintaining the MRS data base and performing system trade-off studies. This level also includes major quality assurance/quality control support to ensure that data obtained for design validation testing meets NRC requirements for future licensing. ($2.1 million)

The FY 1987 and FY 1988 budget requests of $13.6 million and $18.7 million, respectively, reflects a range of resources currently envisioned as necessary to conduct activities authorized by Congress in response to the MRS proposal. A definitive request is not made here in order not to prejudge the proposal.

Transportation and Systems Integration

The FY 1986 budget request for activities associated with Transportation and Systems Integration is $22.6 million. The FY 1987 estimate is $27 million; and the FY 1988 estimate is $18.4 million.

The funding request for FY 1986 provides the support required to develop adequate transportation and integrated systems for the shipping and management of nuclear waste among the various components of the disposal system.

The FY 1986 major activities included in the $22.6 million are as follows:

o Transportation: Work will be conducted in four major task areas: (1) systems acquisition, (2) institutional programs, (3) environment and economic analyses, and (4) technology development systems and testing support. Engineering design for new generation casks testing will begin. DOE will implement a Transportation Business Plan (issued in FY 1985 for public review and comment) to address institutional obstacles and plans and requirements regarding transportation route selection, prenotifications, safeguards, emergency response and equipment safety. This level of funding will also support the conduct of analyses of cask receiving and handling requirements and transportation networks to support MRS and repository programs. ($9.9 million)

o Continue efforts leading to possible techniques, systems or facilities that can be employed at sites other than the repository to optimize overall system performance in terms of safety, cost effectiveness and schedule. Conduct analyses of specific systems concepts, including safety, cost and schedule implications, risk assessments and institutional issuances. Update and upgrade waste form data and acceptance schedules and develop feasibility of standard waste packages and/or canisters. ($12.7 million)

The FY 1987 and FY 1988 estimates of $27 million and $18.4 million, respectively, support continuing system acquisition, institutional programs, environmental and economic analysis, and technology development, data systems and testing support in the transportation area: and engineering development and systems integration.

Program Management and Support

The FY 1986 budget request for program management and technical support is $55.2 million. The FY 1987 estimate is $56.3 million; and the FY 1988 estimate is $59.5 million.

The FY 1986 funding level of $55.2 million will support the following activities:

o Technical support for waste management activities by providing for (a) technical support integration, (b) development of standard materials characterization methods by the Material

Characterization Center, and (c) supporting studies including fund management activities. ($33.8 million)

o Provides for a total of 292 full-time equivalents (FTE's) for positions at headquarters and in the Operations Offices to manage funding, site investigation, technology development and institutional liaison associated with the technical management of the repository, MRS, supporting programs and the management of the Nuclear Waste Fund. ($21.4 million)

The FY 1987 and FY 1988 estimates of $56.3 million and $59.5 million, respectively, will provide for increased program management and technical support associated with site characterization activities at three candidate repository sites, intensified siting efforts in the second repository program, and a vigorous MRS program and increasing efforts in transportation systems development. Major emphasis will continue on developing an integrated cost-effective waste disposal system providing full protection of public health and safety and the environment.

CIVILIAN RADIOACTIVE WASTE R&D PROGRAM

The Nuclear Waste Policy Act requires the Secretary to budget for spent fuel storage R&D; alternative disposal concepts (subseabed) and generic repository research. Development and demonstration activities under the Civilian Radioactive Waste R&D Program are funded from appropriations rather than funds collected from the utilities and deposited into the Nuclear Waste Fund.

The FY 1986 budget request for the Civilian Radioactive Waste R&D activities is $23.4 million.

I would like to briefly discuss the strategy and highlight the activities which we plan to undertake in FY 1986.

Strategy

DOE's Civilian Radioactive Waste R&D program efforts are to utilize all means directed or available through the Act or other authority to encourage and expedite the most efficient use of existing storage facilities and the addition of new capacity in a timely fashion. In addition, in accordance with Section 222 of the Act, DOE will continue research, development and investigations of alternative means and technologies for the permanent disposal of high-level radioactive wastes. In this regard, the subseabed disposal concept is the only alternative currently being studied. Generic R&D and supporting studies are also carried out in support of the waste program.

Spent Fuel Storage R&D

DOE's spent fuel storage development program is to encourage and expedite the most efficient use of existing storage facilities and the addition of new, licensed capacity in a timely fashion. The FY 1986 budget request to support these activities is $8.9 million. FY 1986 activities included in this request are:

o Identify and analyze "mismatches" that may exist between the currently licensed commercial spent fuel shipping cask fleet and the handling capability ties at reactors that could potentially utilize Federal Interim Storage facilities.

o Obtain data from demonstrations of dual-purpose dry shipping/storage casks to aid utilities in the eventual licensing of such casks under NRC regulations. This would strengthen the technical basis for licensing spent fuel transportation in storage casks and would enhance DOE's ability to issue a certificate of compliance, or obtain an NRC license, for future shipment of storage casks after an extended storage period.

o Provide and update spent fuel information and analyses, other special studies and program support.

Alternative Disposal Concepts

In accordance with Section 222 of the Act, DOE will continue research, development and investigations of alternative means and technologies for the permanent disposal of high-level waste. The FY 1986 budget request for these activities is $12.5 million and includes the following activities, all related to the international subseabed program:

o Continue cooperation within the Nuclear Energy Agency Seabed Working Group.

o Acquisition of high-resolution seismic survey maps of at least two site study areas.

o Deployment of the In Situ Heat Transfer Experiment (ISHTE).

o Completion of preliminary tests of sediment hold closure following simulated canister emplacement.

o Continued site-specific physical and biological oceanographic data acquisition.

Generic Methods and Supporting Studies

This program includes three main areas of effort: international program support, special technical reviews and waste management studies. The thrust of these efforts is to assure adequate international cooperation, provide an independent assessment of the technical adequacy of the program and evaluate potential alternatives which could improve the cost, schedule or technical aspects of the Civilian Radioactive Waste R&D programs.

The FY 1986 budget request for generic R&D and supporting studies is $1.7 million.

During FY 1986, DOE's international program efforts will support general and multilateral international agreements. Summary reports will be prepared on the various international programs of the numerous countries emphasizing the status and planning of international waste management activities. Proposed international cooperation activities on testing projects and exchange of information will be evaluated to ascertain the relative net benefit to program objectives. The information exchange contributes to the development of international consensus on the adequacy and safety of geologic disposal of nuclear waste.

In previous years, nonnuclear weapon states were solicited for interest in receiving technical assistance in response to Section 223 of the Act. The requests for assistance have addressed both the technology of spent fuel storage and disposal. We anticipate that additional countries will participate in this program in FY 1986.

DOE will continue to support special technical reviews conducted by the National Adacemy of Science Board of Radioactive Waste Management and evaluations of rock mechanics and tunneling techniques performed by the NAS Committee on Tunneling Technology assisted by the Department of Transportation and the Bureau of Mines in support of waste management activities. DOE will also support fellowship and university programs in the nuclear waste management area.

Program Direction

The FY 1986 budget request for program direction is $325 thousand. At this level, five full-time equivalents would be funded to manage the Civilian Radioactive Waste R&D programs. The personnel required include administrative and technical personnel who manage a broad range of activities which includes research, development, demonstration, industrial involvement and international programs.

In summary, Madam Chairman, the FY 1986 budget request for spending authority under the Nuclear Waste Fund and for appropriations under the Civilian Radioactive Waste R&D budget are designed to carry out an integrated waste management program in an efficient and effective manner and to achieve the 1998 mandate of the Nuclear Waste Policy Act, that is, to have in place a comprehensive and functional waste disposal system to begin receiving spent fuel.

This concludes my remarks in support of the FY 1986 Nuclear Waste Fund and R&D programs. I shall be pleased to answer your questions at this time.

Mr. **Lundine**. DOE published the siting guidelines 1½ years after the 6-month deadline. It plans to recommend 3 sites for characterization 8 months later than the January 1985 deadline in the act. How does the Department of Energy rationalize its attempt to selectively comply with the time deadlines in the Waste Act?

Mr. **Rusche**. Mr. Chairman, I've been involved in a number of activities, both in Government and the private sector, and I've never seen such a conflicting set of demands and interests that the act, I think, is masterful in addressing. I would hope that I might dissuade you from the thought that we are being selective in meeting schedules or being less than fully attentive to the schedules that are provided in the act. In fact, I made a commitment at confirmation and I would reiterate to you a strong recognition of the value and purpose of all of the milestones that are in the act.

But the act does present conflicting demands or conflicting requirements. The act, at the same time, directs us to work cooperatively with the States; it directs us to be thorough and to work with the regulatory authorities—in this program, you will recall, we are not a Government entity; we are functioning like a private entity. We are subject to regulation of the Nuclear Regulatory Commission, to EPA, to DOT, and perhaps other regulatory authorities in both the Federal and in the State governments. And I think in the simplest sense of the word, I have exercised my judgment as to where it is best to put effort—in that we don't have unlimited effort—and where it is best to put priorities in order to achieve, first, a high quality technical result that will withstand both legal and public scrutiny—

Mr. **Lundine**. Speaking of legal scrutiny, though, where the act says shall, don't you think you're subjecting yourself to the possibility of lawsuits by not meeting those deadlines?

Mr. **Rusche**. Yes, I think you're right, sir. But I think at the same time there are places in the act—and I'd be glad to discuss them in detail, if it were appropriate, but I don't think it is now—in which I am given instructions under the act to meet the schedule and, at the same time, conduct a number of other activities concurrently or, as an attendant to that obligation. Those activities are not under my control. And I have exercised judgment and I have concluded that the investment of time at this point is far more valuable for the long-term future of the program than to defer those to a later time.

Mr. **Lundine**. I certainly don't question that; but this is, after all, a $24+ billion program over a period of time and it would seem that delay inevitably would drive costs up, which is the reason for my concern.

Mr. **Rusche**. I'd like to think that doing the job well in selecting sites, working with States—although many States would probably agree that we're not working as well as they would like, nor taking as long as we ought, nor spending as much money as we should—that we have found a balance that gives us the highest confidence that we can meet the obligations of the act in its entirety, and that to short circuit or give less than full attention at this time would expose us to even greater difficulties down the road.

Now, I realize it's a management challenge——

Mr. LUNDINE. Well, it is. When we were writing the law there were a number of us, at least, who were concerned with the absoluteness of the dates that are set forward there.

Let me turn, though, as long as you're talking about doing the job right, to a concern that I have with regard to the mission plan, and others have expressed concern regarding the project decision schedule. Is it the Department's intention to use this mission plan as a blueprint for the Government's action on the waste program?

Mr. RUSCHE. I would not characterize it as a blueprint. I don't believe the act characterizes it as a blueprint. I would characterize it in the simplest way as today's best statement of tomorrow's plans for the program. In that sense it's a blueprint with something less than permanent ink, because the factors that we are working on are subject to change day by day.

Mr. LUNDINE. Well, sure, that's right; but how can it work if it's published after you're already executing what is the subject of the plan?

Mr. RUSCHE. I would argue that, on the contrary, we are not doing that. The only step that we are about to come to any firm action on that would likely have been a major factor in the plan had it been started at an early enough time is the characterization process for the sites. We now hope to publish the final version of the plan—and "final", I would certainly hope, would be taken in quotes; it's "final" for today and certainly going to be subject to revision—but we hope to publish that later this spring. I wish we could have published it last June when I got here. We looked at it; we went through 2 drafts, if you will recall, neither of which were really required by the act but, again,[4] attempting to be thorough and responsive to the interests of all who had an input. And I think that the document we will publish later this spring will serve the purpose of giving people a basis for making informed judgments.

Mr. LUNDINE. That document is scheduled for May, I think your testimony says?

Mr. RUSCHE. That is my best estimate at the moment.

Mr. LUNDINE. I'd like to briefly discuss the monitored retrievable storage. If you recommend the MRS program, do you think that will diminish the support for a repository program?

Mr. RUSCHE. I would hope not. I would hope that the needs and feasibility study and the accompanying documentation that we are preparing, which is not yet final, will make it clear that the role that we envision—and we believe is, in effect, required—is one that makes the repository workable and rather than taking away from the repository will add to the confidence that this country will have a waste disposal system that's functional.

Mr. LUNDINE. I am aware of what the law says with respect to MRS, but if you were to conclude that it is an unnecessary intermediate step would you come back to this committee or the Congress with that recommendation?

Mr. RUSCHE. Yes, sir.

Mr. LUNDINE. That inspires great confidence in you.

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[4] Mr. Rusche would correct this statement by indicating that a draft was required in the Act within 15 months of enactment.

Mr. RUSCHE. Well, I——

Mr. LUNDINE. Well, it does. I'm not being sarcastic here.

Mr. RUSCHE. And I don't mean to be unduly brief, but the question has a straightforward answer. I have looked at it. I looked at it before I was confirmed, and you will recall I did make some statements to the Congress and to the committee at the time of my confirmation. Nothing that I have seen has dissuaded me from the fact that the act was wise in causing us to study it, and that our studies will be, hopefully, dispositive and put us in a position that all of you in Congress can make a judgment as to whether we are right or not. And that's what I think the act requires us to do.

Mr. LUNDINE. Thank you.

Mr. Monson?

Mr. MONSON. Thank you very much.

Following up on a couple of earlier questions, I realize that the Department of Energy has worked diligently to address a number of concerns of the affected States and that the States haven't always cooperated in addressing those concerns. There are also concerns of Indian tribes and the general public. Is this emphasis on public participation a major, or perhaps the major, reason why some of those initial milestones outlined in the act have been delayed?

Mr. RUSCHE. Well, Mr. Monson, I think that I would comment that the commitment that the act requires us to make to public involvement certainly requires time. I would not want to convey the impression, though, that that has been without its value. I think, for example, if you look at the guidelines in which we took by almost any standard an inordinately long time, an extra year beyond the time that the act thought that we ought to take, that the guidelines thus produced were better than they would have been had we not—not just marginally better, but noticeably better, appreciably better—than would have been the case had we not taken that time. And the guidelines are sort of a bedrock on which we make the decisions for the repository. So in that instance, I'd say yes, those kinds of interactive processes were the cause, but they also produced a commensurate benefit.

Mr. MONSON. I'm on your side on that, and I acknowledge that some States, as I've indicated, haven't been as cooperative as they might have been in allowing you to proceed, either.

Concerning the site selection process, and specifically those that are involved in my State of Utah, the Davis Canyon site was included in the environmental assessments and was identified as a site suitable for site characterization, but so far is not being proposed as one of the three sites for characterization. Assuming that Davis Canyon is not characterized, would this site be eligible as a site for the second repository?

Mr. RUSCHE. No. The act provides that sites which are nominated, which is the case for Davis Canyon, but not selected for characterization may not be considered thereafter.

Mr. MONSON. Now, the Lavender Canyon site would not fall into that category?

Mr. RUSCHE. That is correct; and if the data that we have in the environmental assessments which lead to the current proposals remains after we receive all of the comments, then Lavender Canyon would not be nominated and would fall in the category of sites that we could consider again.

Mr. MONSON. What is your interpretation of the requirements pertaining to locations near national parks, then, in the act?

Mr. RUSCHE. Well, the guidelines have some things to say about weighing national parks and other public interest facilities, and we've looked at those very carefully. I think that they do exert an influence on one's choice, and we've attempted to make that evaluation under the guidelines and display that fully in the environmental assessment. Secretary Hodel and I both assured your former Governor and your present Governor—although I have not had the direct discussion with him—that we do not plan to use the park per se, that is, we would not drill in the park, we would not desecrate the park, if I may use it in that sense; the fact that the park is in near proximity might—the fact that the repository is in near proximity to the park might exert some adverse effect on the park itself. But it's very difficult to quantify that. If we got to the place of looking at a site very near such a park, we would take every step possible to avoid damaging the park or detracting from the park. But I think, under the Act, we're charged with looking at sites that appear to have potential and at this stage of the game, I think that the emphasis is on technical and engineering adequacy. When we get to the stage of selecting a site for recommendation as the repository site, which now we estimate to be 2½ to 3 years later than the act requires because of this extensive effort, but in 1990 or 1991, we will look again and we will provide an environmental assessment[5] to support the choice. And of course, the States would have then had their opportunity to exert and express their view, even weighing factors that are not in the guidelines, whether they be social views or political views or whatever. And we've sort of taken the view that we must first have a good technical basis for determining whether a site is adequate. It still may not be sufficient; it still may not be suitable for these other factors, but until we make that first determination, it's just not practical to look at the second ones in quite the detail that some of the States would like for us to look at them at this time, in my opinion.

Mr. MONSON. Where does your timeline now put the selection for the second site?

Mr. RUSCHE. As I indicated in the testimony, the date for recommendation would be about 5 years later, about 1997.

Mr. MONSON. On to another topic. Your prepared statement indicates that the Monitored Retrieval Storage Program will proceed on a parallel basis with the repository development. Does this mean that the MRS Program could never serve as a substitute for developing a permanent repository?

Mr. RUSCHE. In terms of the intent of the act, I don't think that a monitored retrievable storage facility is an adequate substitute for a repository. I would hope I might clarify, perhaps, some of the words I used in both the testimony and in general. We are proceeding with a proposal, which we are obligated to do under the act, and I have described my current view of what that proposal will contain. If Congress adopts the proposal and authorizes us to proceed, which it is very likely that we will propose, then the MRS becomes a reality.

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[5] Mr. Rusche would correct this to read "Environmental Impact Statement."

But I think we are both obligated to take note of the fact that we require yet an authorization of Congress for MRS to become a reality. Conceptually, I speak as if it might be a reality, but it yet must receive the authorization of Congress.

Mr. MONSON. Thank you very much.

Mr. LUNDINE. I would like to ask another question about your research and development. Listening to your oral testimony, I had misunderstood; I thought that the total amount you said you were spending for spent fuel storage R&D and alternative disposal concepts was $8.9 million. But now I see that there are actually two separate amounts—$8.9 million for spent fuel R&D, and $12.5 million for the alternative disposal concept.

Mr. RUSCHE. Yes. I may have misspoken, and if I did, I apologize.

Mr. LUNDINE. That's all right; I may not just have followed it.

I'm a very strong supporter of what you're doing in terms of dry storage demonstration and the like, and I guess I just want to ask the question, knowing what your answer is going to be. Is $8.9 million enough to carry that on in a way that can produce significant results so that, maybe, we can eventually get NRC licensing of that kind of technology if, indeed, your research is positive?

Mr. RUSCHE. We think it is an adequate and timely pace on which to proceed. I think that we have excellent cooperation with at least a couple of utilities now, who are participating in cooperative programs. These dollars do not represent all of the dollars that are being spent, in that the utilities in these particular programs are cooperating on a 3 to 1 basis; that is, for every $1 of Federal money we are spending, $3 are being spent by the utilities in these cooperative programs.

So it is an opportunity to test the licensing process, to develop the technology, and the utilities recognize it as a valuable investment on their part. So this, in my opinion, is a good businesslike way for the Government to be stimulating without driving and overrunning the program.

Mr. LUNDINE. Certainly, in the present atmosphere, I don't want to suggest that you ought to do that.

Similarly, a few years ago I became impressed with the interesting possibilities in the Subseabed Program. You would argue likewise, I assume, that we're not shortchanging that?

Mr. RUSCHE. No, I think we are proceeding on a pace that is consistent with the congressional direction, to be in a position by 1990 to make a feasibility determination. We are joint participants with members of the European community and, I believe, two or three others outside the community. I believe this year our contribution to the total program is about 35 percent of the total program. At one time we were contributing about 50 percent of the total program. I think it's a proper recognition of both the relative priority and importance of the program, and we'll get there by 1990. There are demonstrable experiments and data being gathered, and I think we'll have a sound basis in 1990, which would be in time for, or in the right schedule, for us if we had to look elsewhere for a permanent disposal medium.

Mr. LUNDINE. I have no further questions. Are there any other questions that anyone has?

Mr. MONSON. I have just one more.

On the site selection process, the three sites that are being considered are basically all in the West—Texas, Nevada, and Washington. Are there going to be any considerations of locating one in the East where we're closer to the majority of the producers of the nuclear waste?

Mr. RUSCHE. Yes, sir. In fact, of the some 200 or more sites that are in the screening process in 17 States, all of them are in the upper Midwest or in the East. I believe they're all east of the Mississippi River, if I'm not mistaken. We're looking for other rock types; in this case, we're looking primarily at crystalline rock, although we have a smaller effort that's looking at other types of sedimentary rock. But I think there's great value in diversity to provide us maximum confidence for the very long-term future that we're trying to build into this program.

And in addition, I think that in the integrative system that I've talked about with respect to monitored retrievable storage facilities, it's likely that logistics and analyses will confirm that it ought to be located near the bulk of the reactor generation facilities. The exact location we have not come to yet, and I hope we'll be in a position later on this spring to bring that matter to both public involvement and attention.

Mr. LUNDINE. Thank you. We don't want it to be said that we're not doing anything for the West. [Laughter.]

Mr. MONSON. Sometimes we think you do too much.

Mr. LUNDINE. I must say that I'm delighted that you're holding this position, Mr. Rusche, having worked with you before, as you indicated, and become a real admirer of your competence and dedication. Thank you for your testimony.

The subcommittee has postponed its hearing on the Uranium Enrichment Program with Department of Energy witnesses which was scheduled for tomorrow afternoon. That hearing has been rescheduled for March 5 at 9 a.m. in room 2337.

The subcommittee will meet again on Thursday, February 28, at 1 p.m. in this room to hear witnesses from industry and national laboratories on the Uranium Enrichment Program.

Mr. MONSON. Mr. Chairman?

Mr. LUNDINE. Yes?

Mr. MONSON. May I request that Republican members of the committee have an opportunity to submit questions in writing?

Mr. LUNDINE. Oh, certainly. I did not say that for the record, and should have. Thank you.

I think all members would like the opportunity to submit questions to Mr. Rusche in writing.

Mr. RUSCHE. I'd be pleased to respond promptly.

Mr. MONSON. And also that the staff be given the opportunity to review the responses when they come back. Thank you.

Mr. LUNDINE. The subcommittee is now adjourned.

[Whereupon, at 3:23 p.m., the subcommittee recessed, to reconvene at 1 p.m. on Thursday, February 28, 1985.]

1986 DEPARTMENT OF ENERGY AUTHORIZATION

MONDAY, MARCH 4, 1985

House of Representatives,
Committee on Science and Technology,
Subcommittee on Energy Research and Production,
Washington, DC

The subcommittee met, pursuant to notice, at 1 p.m., in room 2337, Rayburn House Office Building, Hon. Marilyn Lloyd (chairman of the subcommittee) presiding

Members present: Chairman Lloyd, Mr. Stallings, Mr. Morrison, Mr. Monson, Mr. Fawell.

Staff present: Dr. Jack Dugan, subcommittee staff director; Lou Ventre, counsel; Tim Peckinpaugh; Republican technical consultant; and Tom Weimer, Republican energy coordinator.

Mrs. Lloyd. The Subcommittee on Energy Research and Production will come to order. I will ask unanimous consent that the subcommittee permit today's proceedings to be recorded and covered by the media and other persons. Without objection, so ordered.

Good afternoon, ladies and gentleman. We will be hearing from our non-DOE witnesses on the DOE proposed budget on other agencies' complementary programs.

I expressed my concern about these programs at the hearings with DOE last week. I would encourage interested parties to read my statement in the February 25 committee press release which delineates my concern.

Our first witness at today's hearing will be Mr. John Davis who is the Director of the Nuclear Materials, Safety, and Safeguards.

We had expected to hear from Bill Dircks, executive director of operations, but we understand he has been taken ill and is not able to attend the meeting. We hope he makes a speedy recovery.

But John, we are very pleased to have you with us today. The subcommittee will certainly be interested in hearing exactly what the NRC proposed to do in the coming fiscal year and generally what they require from the Department of Energy in order to license a repository for disposal.

Then Mr. Davis will be followed by Mr. Berry and other witnesses.

Before we begin with our first witness I would like to ask our ranking Republican member, the Honorable Sid Morrison from Washington, to make some opening remarks.

Mr. Morrison. Thank you, and good afternoon.

Today we complete our initial consideration of the Federal budget request for civilian nuclear waste management activities.

As I stated in last week's hearing, these programs are critical to the overall effect to safely store, handle, transport, and eventually dispose of high-level nuclear waste.

I am pleased that we are joined today by those Federal agencies outside DOE which are involved and also representatives from both the utilities and nuclear power industry.

The three Federal agencies testifying this afternoon, Madam Chairman, are important to the overall success of the coordinated Nuclear Waste Disposal Program envisioned in the act.

NRC is responsible for licensing the repositories and for enforcing regulatory requirements to assure public health and safety. The activities of the Interior Department, principally the U.S. Geological Survey, are to review geological and hydrological data of the repository sites.

I can speak for how important this is in my particular home area.

EPA is primarily responsible for the development of standards for the protection of the environment from off-site radiation releases from repositories. And the concerns of the utilities are important because of the anticipated shortfall in interim storage capacity and the fact that they are eventually going to pay for the program.

I have taken an active interest in fulfilling the mandates of the Nuclear Waste Policy Act. I share the chairman's concerns that we are missing some of the initial milestones established in the act.

However, I believe that a major reason for the slippage in the schedule has been the sensitivity of the Federal Government to address the concerns of the affected States, Indian tribes, and the public at large.

Our efforts the select, construct, and license two repositories will never succeed unless we gain the full confidence of the public by responding to those public concerns of the States and affected Indian tribes.

I sincerely hope that the Federal agencies represented here today will continue to promote this objective.

The residents of Washington State have several legitimate concerns about siting a repository at Hanford, particularly ground water contamination and transportation.

These concerns must be addressed satisfactorily before Washington or any other State will be willing to accept a repository.

Madam Chairman, again today I will be seeking some answers to those specific concerns. Thank you for this opportunity.

Mrs. LLOYD. Thank you, Sid.

John, your statement is before us and it will be included in its entirety for the record, so you may summarize or proceed just as you wish.

STATEMENT OF JOHN DAVIS, DIRECTOR, OFFICE OF NUCLEAR MATERIAL, SAFETY AND SAFEGUARDS, U.S. NUCLEAR REGULATORY COMMISSION, ACCOMPANIED BY DR. MICHAEL J. BELL, DEPUTY DIRECTOR, DIVISION OF WASTE MANAGEMENT, U.S. NRC

Mr. DAVIS. Madam Chairman, I would prefer to briefly summarize.

I have with me Dr. Michael Bell, Deputy Director of the Division of Waste Management who, of course, is quite familiar with the details of our particular program.

Mrs. LLOYD. We also welcome you to our hearings.

Mr. DAVIS. As requested in your letter of invitation, I am pleased to discuss three subjects relating to Nuclear Waste Policy Act activities:

One, interactions between NRC and DOE;

Two, NRC's requirements of DOE relative to the repository program; and

Three, a brief summary of proposed activities for fiscal year 1986 and fiscal year 1987 regarding the repository program.

As your committee is aware, the NRC's principle responsibility in the high-level waste program is to license high-level waste repositories, providing that an independent NRC determination shows that DOE's performance of its responsibilities meets regulatory requirements and is adquate to protect the public health and safety and the environment.

To differentiate between NRC's responsibility and that of the EPA, EPA has the responsibility to establish generally applicable standards for the protection of the general environment from radioactive material; NRC has the responsibility to assure that the limits established by the EPA standards are not exceeded.

Early ongoing interaction and prelicensing consultation is necessary between the NRC and DOE if the repository program is to be accomplished without costly delay or rework.

For a repository to be licensed the NRC must find in a formal licensing proceeding that the repository will meet regulatory requirements and that there is reasonable assurance that the public health and safety and the environment are adequately protected.

To provide for a thorough, effective, and efficient licensing process for this first of a kind undertaking, the NRC, in a timely manner, must develop the methods for assessing compliance with performance objectives to permit independent determination of the adequacy of the DOE program; provide early guidance to DOE so that DOE can produce essential and acceptable data without costly delay or rework; provide onsite overview of the activities; identify and resolve issues; and provide appropriate and timely review and evaluation of DOE's submittals.

Our first priority is health and safety and we realize this first of a kind undertaking requires close coordination between DOE and NRC if it is to be successfully and safely accomplished.

Assuming the availability of resources and the absence of major safety issues, the NRC program is fashioned so as not to delay the DOE program.

We do have concerns that our fiscal year 1986 resources provided in the President's budget may result in some delay. We will, however, make every effort to minimize any delay.

Turning now to the interactions between DOE and NRC under the Nuclear Waste Policy Act, there are three principal areas in which we interact under the Nuclear Waste Policy Act: High level waste repository, fuel storage, and transportation activities.

In each of these areas we have established what I consider to be a proper framework for communication and coordination between DOE, the agency charged with operation, and NRC, the agency charged with safety regulation.

In 1983 NRC and DOE concluded an agreement covering interaction on DOE's program for repository site investigation and characterization. Our objective has been to identify technical issues early and resolve them where possible in the period before DOE formally submits its license application.

The master agreement is supplemented by agreements focused on implementing exchanges on specific repository projects in various geologic media.

In order to assist this interaction NRC has established onsite licensing representation for the three categories of geologic media involved in DOE's first repository project [basalt, tuff, and salt].

In addition to management coordination on the course and timing of prospective programmatic activities, we have held numerous workshops, data reviews, and other types of technical meetings in our effort to identify, understand, and resolve repository issues.

A listing of these staff coordination meetings is attached to our statement.

NRC and DOE also concluded an agreement in 1983 concerning transportation packaging for spent fuel and high-level waste under provisions of the Nuclear Waste Policy Act. It establishes common planning assumptions and it outlines procedures which NRC and DOE will observe in connection with development of transportation packaging.

The transportation involved would be physical movement to a geologic repository, a test and evaluation facility, a monitored retrievable storage facility, or an interim storage facility.

Activity under this agreement is focused mainly on development of a new generation of shipping casks for spent fuel.

We are continuing our close coordination with DOE on its development and demonstration programs for interim dry spent fuel storage technologies which will provide technical information needed in the licensing process.

Section 218(a) of the Nuclear Waste Policy Act requires DOE to develop a Dry Storage Demonstration Program in cooperation with the industry. Its objective is to establish technologies that NRC may, by rule, approve for industry use without the need—to the maximum extent practicable—for additional NRC site-specific approvals.

So far we have received initial license applications from two utilities for at-reactor dry storage, both of which have cooperative agreements for support by DOE.

We also are reviewing several topical reports on dry storage module designs submitted by potential vendors. We expect to complete a number of these reviews in 1985-86.

This, combined with information gained from DOE programs, will provide us with the experience to develop and publish a rule as contemplated in the Nuclear Waste Policy Act.

The availability of such an approval process of dry storage casks, under rulemaking completed in the 1987-88 timeframe, will serve to assist utilities as the major needs for additional spent fuel storage capacity develop in the 1990's.

Through reracking modifications of existing reactor storage basins, most reactors have storage capacity into the 1990's.

A few sites requiring additional storage capacity in the late 1980's have plans for rod consolidation operations in the existing pools, use of dry storage modules, or limited transshipment to alleviate storage shortfalls.

The staff has established a close interaction with DOE staff responsible for development of the monitored retrievable storage. MRS, proposal to provide regulatory guidance to DOE and to enable us to maintain familiarity with the storage design concepts being pursued by DOE to facilitate our review and comment on the proposal.

We are familiar with the considerations being given by DOE for use of an MRS as part of an integrated waste management system as well as its role as a backup for the repository in event of substantive delay.

With respect to licensing of an MRS, should it be authorized by Congress, we have advised DOE that we consider the technical criteria of our regulation for the licensing of spent fuel storage, 10 CFR Part 72, to be applicable to an MRS.

The staff is preparing a proposed revision to part 72 to cover MRS explicitly. Staff expects to seek public comment this year.

Upon completion, such rulemaking will provide the licensing basis for an MRS if Congress should authorize DOE to proceed.

In concluding my remarks on NRC and DOE interaction I would like to note that the two agencies have consulted on the possibility of funding NRC's high-level waste program from the Nuclear Waste Fund established in section 302 of the Nuclear Waste Policy Act.

There has been interest in such possibility, including interest on the part of OMB.

Our examination of the Congressional Record, including the basis for the initial mil-per-kilwatt-hour fee, does not lead us to a clearly established conclusion that such funding would be within the Congress' intent.

In discussions with DOE it has been recognized that inclusion of licensing as a permitted expenditure—in connection with the Secretary's authority under section 302 to pay for certain costs—may provide a basis for some degree of funding being transferred from DOE to NRC for our Nuclear Waste Policy Act requirements.

We are looking into the possibility of such transfer and various mechanisms that might be suitable to accomplish this.

A final position has not yet been reached.

NRC's chief concern is that DOE, as an NRC licensee, must not be—and must not be perceived to be—in a position to restrict or influence the Commission's judgment in carrying out NRC's safety and environmental responsibilities under the Nuclear Waste Policy Act.

I will now discuss briefly the NRC requirements of DOE relative to the repository program.

These requirements, principally within 10 CFR Part 60, consist of four steps: An early interaction with DOE during site characterization prior to receipt of a license application, a formal hearing on the DOE application prior to construction authorization, a second licensing review and hearing prior to receipt and emplacement of the high-level waste, and a final review with hearing prior to site closure.

Part 60, which consists of procedural rules and technical rules, serves as the basic NRC requirements.

Part 60, which predates the Nuclear Waste Policy Act, currently is undergoing consideration for review to, among other things, assure consistency with the Nuclear Waste Policy Act.

I have attached a copy of the current part 60; attachment C is a listing of rule modifications currently under consideration. (See appendix.)

The provision for early review of DOE's site characterization plans provides an opportunity for NRC to point out those aspects of a site which in the judgment of NRC staff require special attention or may present special problems, as well as an opportunity to indicate particular items or information needed for the Commission to make licensing decisions with respect to the sites being considered.

In addition to the rules which establish the basic requirements, the NRC provides regulatory guidance to the DOE high-level waste repository program through various mechanisms.

This guidance is intended to assist DOE in understanding the rules and in understanding that which NRC considers necessary to meet the rules.

We have issued a regulatory guide which describes the information needed in site characterization plans in order for NRC to evaluate the proposed test programs. This guide is being revised to be consistent with Nuclear Waste Policy Act requirements.

We will be issuing additional guides as appropriate. For example, a guide concerning the format for a license application for a repository is under development.

Staff also has been working on generic technical positions in several areas, for example, borehole and shaft seals and groundwater travel time. It also has provided DOE with drafts of issue oriented site technical positions for each of the nine potential repository sites. These are being discussed with DOE.

As DOE's program goes forward we will produce appropriate additional as well as revised guidance.

Attachment D is a listing of guidance issued and planned.

The guidance basically is aimed at assuring that DOE has timely information so that it can provide and submit to NRC a high quality complete application which will enable an efficient licensing process.

I would like now to review other activities concerning the repository which we plan in fiscal year 1986–87 in addition to rulemaking.

The main work effort will continue to be preapplication reviews of DOE's site investigations. We will maintain close contact with DOE, the States, affected Indian tribes, and technical community and interested members of the general public in our continuing effort to identify and resolve issues at the earliest possible date and thus minimize delays.

Reviews of two DOE documents will be especially significant in regard to the siting activities.

Action on one is nearing completion; that is, review of the draft environmental assessments DOE issued for nine possible sites for a repository.

These drafts were released by DOE on December 20, 1984, for a 90-day public comment period, which ends in mid-March.

NRC staff has a considerable effort underway to review these documents. Each of the 9 documents approaches 1,000 pages in length. Each document is supported by hundreds of referenced documents. We expect to provide comments on the drafts to DOE within the period noted.

Another major action will be review of each general plan for site characterization activities which DOE must prepare for each candidate site.

The site characterization plan documents are expected in 1986.

NRC's ability to comment usefully will be significantly enhanced by continuing staff interaction under the repository agreements I mentioned earlier as well as experience in reviewing the environmental assessment documents.

Deferral of NRC recisions to fiscal year 1986 if DOE maintains its schedules may result in a delay of up to 6 months in DOE's initiation of shaft construction and depth site characterization.

There are a number of other actions which we will be pursuing over the next year or so, and these are described in my full testimony.

In concluding my prepared remarks, I wish to reemphasize that the NRC interest in the program under the Nuclear Waste Policy Act is to provide regulation which will assure that the public health and safety and the environment are adequately protected and that regulatory requirements will be met.

NRC intends to exercise its regulatory program with rigor to provide this assurance. We believe a rigorous regulatory program is essential for the necessary public acceptance of this national program. At the same time we have fashioned our program, assuming we obtain sufficient resources, so that this regulation can be exercised effectively and efficiently.

Thank you, Madam Chairman.

[The prepared statement of Mr. Davis follows:]

MADAM CHAIRMAN, MEMBERS OF THE COMMITTEE:

AS REQUESTED IN YOUR LETTER OF INVITATION, I AM PLEASED TO DISCUSS THREE SUBJECTS RELATING TO NWPA ACTIVITIES: (1) INTERACTIONS BETWEEN NRC AND DOE; (2) NRC'S REQUIREMENTS OF DOE RELATIVE TO THE REPOSITORY PROGRAM; AND (3) A BRIEF SUMMARY OF PROPOSED ACTIVITIES FOR FY 86 AND FY 87 REGARDING THE REPOSITORY PROGRAM.

AS YOUR COMMITTEE IS AWARE, THE NUCLEAR REGULATORY COMMISSION'S PRINCIPLE RESPONSIBILITY IN THE HIGH-LEVEL WASTE PROGRAM IS TO LICENSE HIGH-LEVEL WASTE REPOSITORIES, PROVIDING THAT AN INDEPENDENT NRC DETERMINATION SHOWS THAT DOE'S PERFORMANCE OF ITS RESPONSIBILITIES MEETS REGULATORY REQUIREMENTS AND IS ADEQUATE TO PROTECT THE PUBLIC HEALTH AND SAFETY AND THE ENVIRONMENT. (TO DIFFERENTIATE BETWEEN NRC'S RESPONSIBILITY AND THAT OF THE ENVIRONMENTAL PROTECTION AGENCY (EPA), EPA HAS THE RESPONSIBILITY TO ESTABLISH GENERALLY APPLICABLE STANDARDS FOR THE PROTECTION OF THE GENERAL ENVIRONMENT FROM RADIOACTIVE MATERIAL; NRC HAS THE RESPONSIBILITY TO ASSURE THAT THE LIMITS ESTABLISHED BY THE EPA STANDARDS ARE NOT EXCEEDED.) EARLY, ON-GOING INTERACTION AND PRELICENSING CONSULTATION IS NECESSARY BETWEEN THE NRC AND DOE IF THE REPOSITORY PROGRAM IS TO BE ACCOMPLISHED WITHOUT COSTLY DELAY OR REWORK.

FOR A REPOSITORY TO BE LICENSED, THE NRC MUST FIND IN A FORMAL LICENSING PROCEEDING THAT THE REPOSITORY WILL MEET REGULATORY REQUIREMENTS AND THAT THERE IS REASONABLE ASSURANCE THAT THE PUBLIC HEALTH AND SAFETY AND THE ENVIRONMENT ARE ADEQUATELY

PROTECTED. TO PROVIDE FOR A THOROUGH, EFFECTIVE AND EFFICIENT LICENSING PROCESS FOR THIS FIRST-OF-A-KIND UNDERTAKING, THE NRC, IN A TIMELY MANNER, MUST DEVELOP THE METHODS FOR ASSESSING COMPLIANCE WITH PERFORMANCE OBJECTIVES TO PERMIT INDEPENDENT DETERMINATION OF THE ADEQUACY OF THE DOE PROGRAM; PROVIDE EARLY GUIDANCE TO DOE SO THAT DOE CAN PRODUCE ESSENTIAL AND ACCEPTABLE DATA WITHOUT COSTLY DELAY OR REWORK; PROVIDE ON-SITE OVERVIEW OF ACTIVITIES; IDENTIFY AND RESOLVE ISSUES; AND PROVIDE APPROPRIATE AND TIMELY REVIEW AND EVALUATION OF DOE'S SUBMITTALS.

OUR FIRST PRIORITY IS HEALTH AND SAFETY, AND WE REALIZE THIS FIRST-OF-A-KIND UNDERTAKING REQUIRES CLOSE COORDINATION BETWEEN DOE AND NRC IF IT IS TO BE SUCCESSFULLY AND SAFELY ACCOMPLISHED. ASSUMING THE AVAILABILITY OF RESOURCES AND THE ABSENCE OF MAJOR SAFETY ISSUES, THE NRC PROGRAM IS FASHIONED SO AS NOT TO DELAY THE DOE PROGRAM. WE DO HAVE CONCERNS THAT OUR FY 86 RESOURCES PROVIDED IN THE PRESIDENT'S BUDGET MAY RESULT IN SOME DELAY. WE WILL MAKE EVERY EFFORT TO MINIMIZE ANY DELAY.

INTERACTIONS BETWEEN DOE AND NRC

TURNING NOW TO THE INTERACTIONS BETWEEN DOE AND NRC UNDER NWPA, THERE ARE THREE PRINCIPAL AREAS IN WHICH WE INTERACT UNDER NWPA: HIGH-LEVEL WASTE REPOSITORY, FUEL STORAGE, AND TRANSPORTATION ACTIVITIES. IN EACH OF THESE AREAS WE HAVE ESTABLISHED, WHAT I CONSIDER TO BE, A PROPER FRAMEWORK FOR COMMUNICATION AND COORDINATION BETWEEN DOE -- THE AGENCY CHARGED WITH OPERATION -- AND NRC -- THE AGENCY CHARGED WITH SAFETY REGULATION.

IN 1983, NRC AND DOE CONCLUDED AN AGREEMENT COVERING INTERACTION ON DOE'S PROGRAM FOR REPOSITORY SITE INVESTIGATION AND CHARACTERIZATION. OUR OBJECTIVE HAS BEEN TO IDENTIFY TECHNICAL ISSUES EARLY AND RESOLVE THEM WHERE POSSIBLE IN THE PERIOD BEFORE DOE FORMALLY SUBMITS ITS LICENSE APPLICATION. THE MASTER AGREEMENT IS SUPPLEMENTED BY AGREEMENTS FOCUSED ON IMPLEMENTING EXCHANGES ON SPECIFIC REPOSITORY PROJECTS IN VARIOUS GEOLOGIC MEDIA. IN ORDER TO ASSIST THIS INTERACTION, NRC HAS ESTABLISHED ON-SITE LICENSING REPRESENTATION FOR THE THREE CATEGORIES OF GEOLOGIC MEDIA INVOLVED IN DOE'S FIRST REPOSITORY PROJECT (BASALT, TUFF, AND SALT). IN ADDITION TO MANAGEMENT COORDINATION ON THE COURSE AND TIMING OF RESPECTIVE PROGRAMMATIC ACTIVITIES, WE HAVE HELD NUMEROUS WORKSHOPS, DATA REVIEWS AND OTHER TYPES OF TECHNICAL MEETINGS IN OUR EFFORT TO IDENTIFY, UNDERSTAND AND RESOLVE REPOSITORY ISSUES. ATTACHMENT A LISTS THESE SCHEDULED STAFF COORDINATION MEETINGS.

NRC AND DOE ALSO CONCLUDED AN AGREEMENT IN 1983 CONCERNING TRANSPORTATION PACKAGING FOR SPENT FUEL AND HIGH-LEVEL WASTE UNDER PROVISIONS OF THE NWPA. IT ESTABLISHES COMMON PLANNING ASSUMPTIONS, AND IT OUTLINES PROCEDURES WHICH NRC AND DOE WILL OBSERVE IN CONNECTION WITH DEVELOPMENT OF TRANSPORTATION PACKAGING. THE TRANSPORTATION INVOLVED WOULD BE PHYSICAL MOVEMENT TO A GEOLOGIC REPOSITORY, A TEST AND EVALUATION FACILITY, A MONITORED RETRIEVABLE STORAGE FACILITY, OR AN INTERIM STORAGE FACILITY. ACTIVITY UNDER THIS AGREEMENT IS FOCUSED MAINLY ON DEVELOPMENT OF A NEW GENERATION OF SHIPPING CASKS FOR SPENT FUEL.

WE ARE CONTINUING OUR CLOSE COORDINATION WITH DOE ON ITS DEVELOPMENT AND DEMONSTRATION PROGRAMS FOR INTERIM DRY SPENT FUEL STORAGE TECHNOLOGIES, WHICH WILL PROVIDE TECHNICAL INFORMATION NEEDED IN THE LICENSING PROCESS. SECTION 218(A) OF THE NWPA REQUIRES DOE TO DEVELOP A DRY STORAGE DEMONSTRATION PROGRAM IN COOPERATION WITH THE INDUSTRY. ITS OBJECTIVE IS TO ESTABLISH TECHNOLOGIES THAT NRC MAY, BY RULE, APPROVE FOR INDUSTRY USE WITHOUT THE NEED -- TO THE MAXIMUM EXTENT PRACTICABLE -- FOR ADDITIONAL NRC SITE-SPECIFIC APPROVALS. SO FAR, WE HAVE RECEIVED INITIAL LICENSE APPLICATIONS FROM TWO UTILITIES FOR AT-REACTOR DRY STORAGE, BOTH OF WHICH HAVE COOPERATIVE AGREEMENTS FOR SUPPORT BY DOE. WE ALSO ARE REVIEWING SEVERAL TOPICAL REPORTS ON DRY-STORAGE-MODULE DESIGNS SUBMITTED BY POTENTIAL VENDORS. WE EXPECT TO COMPLETE A NUMBER OF THESE REVIEWS IN 1985-1986. THIS, COMBINED WITH INFORMATION GAINED FROM DOE PROGRAMS, WILL PROVIDE US WITH THE EXPERIENCE TO DEVELOP AND PUBLISH A RULE AS CONTEMPLATED IN THE NWPA. THE AVAILABILITY OF SUCH AN APPROVAL PROCESS FOR DRY STORAGE CASKS, UNDER RULEMAKING COMPLETED IN THE 1987-1988 TIMEFRAME, WILL SERVE TO ASSIST UTILITIES AS THE MAJOR NEEDS FOR ADDITIONAL SPENT FUEL STORAGE CAPACITY DEVELOP IN THE 1990'S. THROUGH RE-RACKING MODIFICATIONS OF EXISTING REACTOR STORAGE BASINS, MOST REACTORS HAVE STORAGE CAPACITY INTO THE 1990'S. A FEW SITES REQUIRING ADDITIONAL STORAGE CAPACITY IN THE LATE 1980'S HAVE PLANS FOR ROD CONSOLIDATION OPERATIONS IN THE EXISTING POOLS, USE OF DRY STORAGE MODULES, OR LIMITED TRANSSHIPMENT TO ALLEVIATE STORAGE SHORTFALLS.

THE STAFF HAS ESTABLISHED A CLOSE INTERACTION WITH DOE STAFF RESPONSIBLE FOR DEVELOPMENT OF THE MONITORED RETRIEVABLE STORAGE (MRS) PROPOSAL TO PROVIDE REGULATORY GUIDANCE TO DOE AND TO ENABLE US TO MAINTAIN FAMILIARITY WITH THE STORAGE DESIGN CONCEPTS BEING PURSUED BY DOE TO FACILITATE OUR REVIEW AND COMMENT ON THE PROPOSAL. WE ARE FAMILIAR WITH THE CONSIDERATIONS BEING GIVEN BY DOE FOR USE OF AN MRS AS PART OF AN INTEGRATED WASTE MANAGEMENT SYSTEM AS WELL AS ITS ROLE AS A BACKUP FOR THE REPOSITORY IN EVENT OF SUBSTANTIVE DELAY.

WITH RESPECT TO LICENSING OF AN MRS, SHOULD IT BE AUTHORIZED BY CONGRESS, WE HAVE ADVISED DOE THAT WE CONSIDER THE TECHNICAL CRITERIA OF OUR REGULATION FOR THE LICENSING OF SPENT FUEL STORAGE, 10 CFR PART 72, TO BE APPLICABLE TO AN MRS. THE STAFF IS PREPARING A PROPOSED REVISION TO PART 72 TO COVER MRS EXPLICITLY. STAFF EXPECTS TO SEEK PUBLIC COMMENT THIS YEAR. UPON COMPLETION, SUCH RULEMAKING WILL PROVIDE THE LICENSING BASIS FOR AN MRS IF CONGRESS SHOULD AUTHORIZE DOE TO PROCEED.

IN CONCLUDING MY REMARKS ON NRC/DOE INTERACTION, I WOULD LIKE TO NOTE THAT THE TWO AGENCIES HAVE CONSULTED ON THE POSSIBILITY OF FUNDING NRC'S HIGH-LEVEL WASTE PROGRAM FROM THE NUCLEAR WASTE FUND ESTABLISHED IN SECTION 302 OF THE NWPA. THERE HAS BEEN INTEREST IN SUCH POSSIBILITY, INCLUDING INTEREST ON THE PART OF OMB. OUR EXAMINATION OF THE CONGRESSIONAL RECORD, INCLUDING THE BASIS FOR THE INITIAL MILL-PER-KILOWATT-HOUR FEE, DOES NOT LEAD US TO A CLEARLY ESTABLISHED CONCLUSION THAT SUCH FUNDING WOULD BE WITHIN

THE CONGRESS'S INTENT. IN DISCUSSIONS WITH DOE, IT HAS BEEN RECOGNIZED THAT INCLUSION OF "LICENSING" AS A PERMITTED EXPENDITURE -- IN CONNECTION WITH THE SECRETARY'S AUTHORITY UNDER SECTION 302 TO PAY FOR CERTAIN COSTS -- MAY PROVIDE A BASIS FOR SOME DEGREE OF FUNDING BEING TRANSFERRED FROM DOE TO NRC FOR OUR NWPA REQUIREMENTS. WE ARE LOOKING INTO THE POSSIBILITY OF SUCH TRANSFER AND VARIOUS MECHANISMS WHICH MIGHT BE SUITABLE TO ACCOMPLISH THIS. A FINAL POSITION HAS NOT YET BEEN REACHED. NRC'S CHIEF CONCERN IS THAT DOE, AS AN NRC LICENSEE, MUST NOT BE -- AND MUST NOT BE PERCEIVED TO BE -- IN A POSITION TO RESTRICT OR INFLUENCE THE COMMISSION'S JUDGMENT IN CARRYING OUT NRC'S SAFETY AND ENVIRONMENTAL RESPONSIBILITIES UNDER THE NWPA.

NRC REQUIREMENTS OF DOE RELATIVE TO THE REPOSITORY PROGRAM

I NOW WILL DISCUSS BRIEFLY THE NRC REQUIREMENTS OF DOE RELATIVE TO THE REPOSITORY PROGRAM. THESE REQUIREMENTS, PRINCIPALLY WITHIN 10 CFR PART 60, CONSIST OF FOUR STEPS: AN EARLY INTERACTION WITH DOE DURING SITE CHARACTERIZATION PRIOR TO RECEIPT OF A LICENSE APPLICATION, A FORMAL HEARING ON THE DOE APPLICATION PRIOR TO CONSTRUCTION AUTHORIZATION, A SECOND LICENSING REVIEW AND HEARING PRIOR TO RECEIPT AND EMPLACEMENT OF THE HLW, AND A FINAL REVIEW WITH HEARING PRIOR TO SITE CLOSURE. PART 60 -- WHICH CONSISTS OF PROCEDURAL RULES AND TECHNICAL RULES -- SERVES AS THE BASIC NRC REQUIREMENTS. PART 60, WHICH PREDATES THE NWPA, CURRENTLY IS UNDERGOING CONSIDERATION FOR REVISION TO, AMONG OTHER THINGS, ASSURE CONSISTENCY WITH THE NWPA. ATTACHMENT B IS A COPY OF THE CURRENT PART 60; ATTACHMENT C IS A LISTING OF RULE MODIFICATIONS CURRENTLY UNDER CONSIDERATION.

THE PROVISION FOR EARLY REVIEW OF DOE'S SITE CHARACTERIZATION PLANS PROVIDES AN OPPORTUNITY FOR NRC TO POINT OUT THOSE ASPECTS OF A SITE WHICH, IN THE JUDGMENT OF NRC STAFF, REQUIRE SPECIAL ATTENTION OR MAY PRESENT SPECIAL PROBLEMS AS WELL AS AN OPPORTUNITY TO INDICATE PARTICULAR ITEMS OR INFORMATION NEEDED FOR THE COMMISSION TO MAKE LICENSING DECISIONS WITH RESPECT TO THE SITES BEING CONSIDERED. IN ADDITION TO THE RULES WHICH ESTABLISH THE BASIC REQUIREMENTS, THE NRC PROVIDES REGULATORY GUIDANCE TO THE DOE HLW REPOSITORY PROGRAM THROUGH VARIOUS MECHANISMS. THIS GUIDANCE IS INTENDED TO ASSIST DOE IN UNDERSTANDING THE RULES AND IN UNDERSTANDING THAT WHICH NRC CONSIDERS NECESSARY TO MEET THE RULES. WE HAVE ISSUED A REGULATORY GUIDE WHICH DESCRIBES THE INFORMATION NEEDED IN SITE CHARACTERIZATION PLANS IN ORDER FOR NRC TO EVALUATE THE PROPOSED TEST PROGRAMS. THIS GUIDE IS BEING REVISED TO BE CONSISTENT WITH NWPA REQUIREMENTS. WE WILL BE ISSUING ADDITIONAL GUIDES AS APPROPRIATE. FOR EXAMPLE, A GUIDE CONCERNING THE FORMAT FOR A LICENSE APPLICATION FOR A REPOSITORY IS UNDER DEVELOPMENT.

STAFF ALSO HAS BEEN WORKING ON GENERIC TECHNICAL POSITIONS IN SEVERAL AREAS, E.G., BOREHOLE AND SHAFT SEALS AND GROUND WATER TRAVEL TIME. IT ALSO HAS PROVIDED DOE WITH DRAFTS OF ISSUE-ORIENTED SITE TECHNICAL POSITIONS FOR EACH OF THE NINE POTENTIAL REPOSITORY SITES. THESE ARE BEING DISCUSSED WITH DOE.

AS DOE'S PROGRAM GOES FORWARD WE WILL PRODUCE APPROPRIATE ADDITIONAL, AS WELL AS REVISED, GUIDANCE. ATTACHMENT D IS A LISTING

OF GUIDANCE ISSUED AND PLANNED. THE GUIDANCE BASICALLY IS AIMED AT ASSURING THAT DOE HAS TIMELY INFORMATION SO THAT IT CAN PROVIDE AND SUBMIT TO NRC A HIGH QUALITY, COMPLETE APPLICATION WHICH WILL ENABLE AN EFFICIENT LICENSING PROCESS.

NRC PROPOSED ACTIVITIES FOR FY 86 & FY 87 FOR REPOSITORY PROGRAM

I WOULD LIKE TO REVIEW NOW OTHER ACTIVITIES CONCERNING THE REPOSITORY WHICH WE PLAN IN FY 86-87 IN ADDITION TO RULEMAKING.

THE MAIN WORK EFFORT WILL CONTINUE TO BE PRE-APPLICATION REVIEWS OF DOE'S SITE INVESTIGATIONS. WE WILL MAINTAIN CLOSE CONTACT WITH DOE, THE STATES, AFFECTED INDIAN TRIBES, AND TECHNICAL COMMUNITY AND INTERESTED MEMBERS OF THE GENERAL PUBLIC IN OUR CONTINUING EFFORT TO IDENTIFY AND RESOLVE ISSUES AT THE EARLIEST POSSIBLE DATE AND THUS MINIMIZE DELAYS.

REVIEWS OF TWO DOE DOCUMENTS WILL BE ESPECIALLY SIGNIFICANT IN REGARD TO THE SITING ACTIVITIES. ACTION ON ONE IS NEARING COMPLETION, I.E., REVIEW OF THE DRAFT ENVIRONMENTAL ASSESSMENTS DOE ISSUED FOR NINE POSSIBLE SITES FOR A REPOSITORY. THESE DRAFTS WERE RELEASED BY DOE ON DECEMBER 20, 1984, FOR A 90-DAY PUBLIC COMMENT PERIOD, WHICH ENDS IN MID-MARCH. NRC STAFF HAS A CONSIDERABLE EFFORT UNDERWAY TO REVIEW THESE DOCUMENTS. EACH OF THE NINE DOCUMENTS APPROACHES 1,000 PAGES IN LENGTH. EACH DOCUMENT IS SUPPORTED BY HUNDREDS OF REFERENCED DOCUMENTS. WE EXPECT TO PROVIDE COMMENTS ON THE DRAFTS TO DOE WITHIN THE PERIOD NOTED.

ANOTHER MAJOR ACTION WILL BE REVIEW OF EACH GENERAL PLAN FOR SITE CHARACTERIZATION ACTIVITIES WHICH DOE MUST PREPARE FOR EACH CANDIDATE SITE. THE SITE CHARACTERIZATION PLAN DOCUMENTS ARE EXPECTED IN 1986. NRC'S ABILITY TO COMMENT USEFULLY WILL BE SIGNIFICANTLY ENHANCED BY CONTINUING STAFF INTERACTION UNDER THE REPOSITORY AGREEMENTS I MENTIONED EARLIER, AS WELL AS EXPERIENCE IN REVIEWING THE ENVIRONMENTAL ASSESSMENT DOCUMENTS.

THERE ARE A NUMBER OF OTHER ACTIONS WHICH WE WILL BE PURSUING OVER THE NEXT YEAR OR SO. LET ME DESCRIBE THESE BRIEFLY.

DOE'S MISSION PLAN. THIS DOCUMENT IS REQUIRED BY SECTION 301 OF THE NWPA "TO PROVIDE AN INFORMATIONAL BASIS SUFFICIENT TO PERMIT INFORMED DECISIONS TO BE MADE IN CARRYING OUT THE REPOSITORY PROGRAM" AND THE R&D PROGRAMS REQUIRED UNDER THE ACT. PURSUANT TO THE SECTION'S REQUIREMENTS, NRC RECEIVED THE PLAN IN DRAFT FOR REVIEW LAST MAY, AND OUR COMMENTS WERE FORWARDED TO DOE LAST JUNE. WE UNDERSTAND THAT DOE EXPECTS TO SUBMIT THE FINAL DOCUMENT TO CONGRESS FAIRLY SOON. NRC STAFF WILL REVIEW IT TO IDENTIFY EFFECTS ON OUR ACTIVITIES AND SCHEDULES AND, RELATEDLY, RESOURCE REQUIREMENTS. WE ALSO WILL MONITOR UPDATES AS PREPARED BY DOE.

DOE'S PROJECT DECISION SCHEDULE. SECTION 114 REQUIRES DOE TO PREPARE AND UPDATE A SCHEDULE THAT PORTRAYS THE OPTIMUM WAY FOR ATTAINING OPERATION OF A NUCLEAR WASTE REPOSITORY WITHIN PRESCRIBED TIME PERIODS. THE ACT REQUIRES THAT THIS BE DONE IN COOPERATION WITH ALL AFFECTED FEDERAL AGENCIES. DOE PROPOSED A

PRELIMINARY DRAFT SCHEDULE FOR PROMPT REVIEW ON JANUARY 14, 1985. A FORMAL DRAFT IS EXPECTED WITHIN ABOUT A MONTH OR SO. THE FINAL DRAFT IS EXPECTED IN THE SUMMER. IN ADDITION TO PROVIDING INFORMATION ON WHICH TO BASE OUR OPERATIONAL PLANS, THE SCHEDULE ALSO CAN AFFECT HOW WE PROCEED IN PREPARING BUDGET REQUESTS.

DEFENSE WASTE DISPOSAL. LAST FALL, NRC COMMENTED ON DOE'S DRAFT REPORT WHICH CONCLUDED THAT, FOR REASONS OF COST ADVANTAGE, DEFENSE WASTES SHOULD BE DISPOSED OF IN A COMBINED COMMERCIAL AND DEFENSE REPOSITORY. WHILE WE HAVE NO FURTHER SCHEDULED ACTION AT THIS TIME IN THIS AREA, WE ARE MONITORING DOE'S ACTIONS. WE ARE AWAITING FURTHER DETAILS CONCERNING SUCH COMBINED REPOSITORY IN ORDER TO DETERMINE RESOURCE IMPACTS. THERE WOULD BE SIGNIFICANT REQUIREMENTS SHOULD THERE BE NEED FOR LICENSING A SEPARATE REPOSITORY FOR DEFENSE WASTES.

TEST & EVALUATION FACILITY (TEF). DOE HAS NOT YET ANNOUNCED WHETHER IT WILL PURSUE DEVELOPMENT OF A TEF, WHICH IS AUTHORIZED IN SECTION 213(A) OF THE NWPA. THE ACT CALLS FOR SEVERAL AREAS OF NRC/DOE INTERACTION, SHOULD A TEF BE BUILT. A WRITTEN AGREEMENT WOULD BE REQUIRED ON PROCEDURES FOR TEF INTERACTION. NRC WOULD BE REQUIRED TO CONDUCT A CONTINUING ANALYSIS OF TEF ACTIVITIES TO EVALUATE THE ADEQUACY OF THE CONSIDERATION OF PUBLIC HEALTH AND SAFETY ISSUES. NRC CONCURRENCE WOULD BE REQUIRED ON DECONTAMINATION AND DECOMMISSIONING OF DOE'S FACILITY.

ATTACHMENT E IS AN NRC STAFF ANALYSIS OF THE REQUIREMENTS OF THE NWPA. NRC'S SCHEDULING OF ITS ACTIVITIES UNDER THESE REQUIREMENTS IS CONTINGENT, TO A LARGE DEGREE, ON THE DOE SCHEDULING. ATTACHMENT F IS A LISTING OF PRINCIPLE NRC MILESTONES IN FY 86-87.

IN CONCLUDING MY PREPARED REMARKS, I WISH TO REEMPHASIZE THAT THE NRC INTEREST IN THE PROGRAM UNDER THE NWPA IS TO PROVIDE REGULATION WHICH WILL ASSURE THAT THE PUBLIC HEALTH AND SAFETY AND THE ENVIRONMENT ARE ADEQUATELY PROTECTED, AND THAT REGULATORY REQUIREMENTS WILL BE MET. NRC INTENDS TO EXERCISE ITS REGULATORY PROGRAM WITH RIGOR TO PROVIDE THIS ASSURANCE. WE BELIEVE A RIGOROUS REGULATORY PROGRAM IS ESSENTIAL FOR THE NECESSARY PUBLIC ACCEPTANCE OF THIS NATIONAL PROGRAM. AT THE SAME TIME, WE HAVE FASHIONED OUR PROGRAM -- ASSUMING WE OBTAIN SUFFICIENT RESOURCES -- SO THAT THIS REGULATION CAN BE EXERCISED EFFECTIVELY AND EFFICIENTLY.

THANK YOU.

ATTACHMENTS

A. NRC HLW TECHNICAL MEETINGS WITH DOE
B. FR 10 CFR PART 60 (FR VOL.46 NO.37)
C. MODIFICATIONS TO 10 CFR PART 60
D. NRC LICENSING GUIDANCE
E. NRC NUCLEAR WASTE POLICY ACT REQUIREMENTS
F. PRINCIPAL NRC NWPA ACTIVITIES FOR FY86-87

Mrs. LLOYD. Thank you very much, Mr. Davis.

You mentioned the basic framework and the activities where you would be working with the Department of Energy on the representative program. How do you view your relationships with the Department of Energy? Is this relationship working well?

Mr. DAVIS. Yes.

Mrs. LLOYD. Are there any problems or any snags?

Mr. DAVIS. I would say we have a very businesslike relationship with DOE. If the Chair may recall, some years past when we were beginning this relationship, I guess one could describe it as somewhat rocky. But since that time, I think we have had a smoothing out of this relationship. We do have these written agreements with them and it is proceeding, I would say, quite well, in a very businesslike manner at the present time.

Mrs. LLOYD. That is very good to know.

In February of this year, Chairman Paladino, I believe, testified before the Interior Committee and he stated that the NRC constraints could delay DOE's initiation of shaft construction and the depth of the characterization work by as much as 6 months. If this is true, if so, what budgets are affected by how much should they be increased to eliminate the delay?

In addition to that, I would like to turn to, I believe, it is page 6 of your testimony where you state that the inclusion of licensing as a permitted expenditure was certainly appropriate. Do you feel that part of the licensing should be paid for by DOE's budget? If so, how does it affect the Interior Committee's budget? How does it affect the NRC's budget?

Mr. DAVIS. Madam Chairman, the decision is whether to try to fund at least a portion of our budget from the Nuclear Waste Fund is one before the Commissioners at the present time. No final answer has come from that.

Mrs. LLOYD. Is this consistent with the law, Mr. Davis?

Mr. DAVIS. We can find nothing in the law which says it is to be funded from the fund—is not to be funded from the fund.

Mrs. LLOYD. If it is funded through DOE, it wouldn't basically affect, it wouldn't delay the NRC in your site characterization and work?

Mr. DAVIS. If I may speak to that just a moment, Madam Chairman.

We have projected a delay up to about 6 months on the site characterization work, assuming, of course, that DOE meets schedules.

Now, that delay is founded on a shortfall of $1.8 million and seven FTE's.

Mrs. LLOYD. And what?

Mr. DAVIS. Seven positions in the High Level Waste Program within the budget.

Mrs. LLOYD. OK.

Mr. DAVIS. Again, I would like to emphasize, however, that if the DOE schedule is nct maintained, we may not have this shortfall. But as it is now our projection, assuming DOE maintains their schedule would be up to a 6 months' delay.

Mrs. LLOYD. How about reprogramming some of this money?

Mr. Davis. We have looked, as I would like—we have scrubbed, looking for it, Madam Chairman, and simply have been unable to find it, in view of other priorities facing the agency.

Mrs. Lloyd. You have sort of swept out the closet?

Mr. Davis. We think so.

Mrs. Lloyd. For a total of $1.8 million?

Mr. Davis. $1.8 million and seven positions, yes.

Mrs. Lloyd. Do you still believe that NRC can license the first repository in 3 years as required by the act?

Mr. Davis. That account for us to license in 3 years is highly dependent on the success of the interaction we are having with DOE today. If, in fact, that interaction results in identifying issues early as they appear at least coming to some technical resolution of these resolutions and if DOE submits what we would call a high quality application, we maintain 3 years should do it. But it is dependent on the success of this early interaction.

Mrs. Lloyd. How much of your proposed $11.8 million budget for fiscal year 1986 and of the fiscal year 1987 estimate of $14 million in Waste Management Science and Health Programs is actually allocated to repository-related activities?

Mr. Davis. In the research moneys, about $3 million of that is aimed toward the high-level waste repository.

Mrs. Lloyd. Very well.

Mr. Morrison? I think my 5 minutes are up.

Mr. Morrison. I am a little concerned, Mr. Davis, with this delay again which may not end up being a burden to you since there may be other delays coming along. Could you give me an idea of the timing as far as the transportation cask is concerned?

Mr. Davis. Transportation, yes. We at the present time have an active program of interchange with DOE on the transportation cask situation. As you will recall, one of the provisions of the Nuclear Waste Policy Act is that we come up with some method to generically approve dry cask storage. The concept that we are looking at the present time would be to review cask designs and if appropriate issue a series which would be associated with the cask design to the vendor or the manufacturer of the cask. This would establish certain permitted uses of the cask. Then with regard to the utilities use of that cask, the technique we are considering now is to develop an agency license approach which would, in effect, be a generic licensing technique. This would establish specific conditions under which the licensee would be allowed to use a certified cask, such conditions as loading placement and so forth.

This, of course, will solve rulemaking. We hope to come out with our advance notice of rulemaking midyear next year with a final rule in calendar year 1988 or 1989 which should be in advance of the need for these casks.

Mr. Morrison. I notice you include in your testimony that there may have to be some transshipment for those reactors that are running out of space. I just want to make sure you have those two requirements in mind.

Mr. Davis. Right, sir.

Mr. Morrison. Thank you.

You mentioned that the environmental assessments and your role in reacting to those and the pressure of dealing with it involve those assessments within the 90-day comment period; do you have sufficient time to react during those 90 days?

Mr. DAVIS. Well, we don't have any excess time, but we have marked our staff and they have been working diligently to respond to these EA's and we believe we can meet that date with meaningfull comments.

Mr. MORRISON. OK. Some others are having trouble.

Mr. DAVIS. That is correct, sir.

Mr. MORRISON. Speaking of those others, some of the States and affected parties are asking for or at least giving serious consideration to some sort of independent State monitoring and perhaps even regulatory control over transportation and disposal of high-level wastes. Of course, that is basically your turf and I am wondering if you have given any consideration at all to these requests for independent involvement and evaluation and if those wishes are to be granted, do they interfere with your regulatory processes?

Mr. DAVIS. Sir, I believe one of the actions that the affected States have great interest in having is what DOE is doing in its developing its program. And they will be watching that to some degree. There is a question about whether this development of that program should involve the tagging of independent samples, independent boreholes, this type of thing. I believe that is a question that the States have approached DOE on.

With regard to our transportation role, we have been interacting to some degree with the States and we do intend this summer to have a meeting with States to explain our role in transportation, DOT's role and we hope through that meeting to come to some closer meeting of the minds. We think it is essential that the States understands truly what we do in this regulation.

Mr. MORRISON. Madam Chairman, I want to close my time by saying that this last statement, I think, is significant in that I find the States are not aware of the role that you play and the fact that there are other players there involved in this process besides the Department of Energy. And that probably would short circuit a lot of dual and duplicate involvement on downstream. So I would commend you.

In fact, maybe the subcommittee can monitor in some way these conferences when they are held. We would be very happy for you to.

Mrs. LLOYD. I appreciate that thought, it is well taken, Mr. Morrison. Go ahead.

Mr. MORRISON. No more; that is fine.

Mrs. LLOYD. Thank you very much, Mr. Morrison.

Mr. Davis, in addition to the $11.8 million for 1987 that we just discussed in your Waste Management Science and Health Program that is related to the department related activities, are there other funds in the NRC's proposed budget that are to be used for the repository-related activities in addition to the $7 million for 1986 and the $8 million for 1987 in the Office of Nuclear Material Safeguards?

Mr. DAVIS. Yes, Madam Chairman. The $3 million is really in our office of research. That supports our program, within MSS for the High-Level Waste Program, recognizing that the High-Level Waste Program is the major, but a subset of NWPA activities, we have about 115 positions in fiscal year 1986 and about $6.7 million of contract support more than is associated with that. I would be glad to submit for the record, Madam Chairman, a complete breakdown.

Mrs. LLOYD. Could you give us for the record a breakdown on the level of personnel that is involved?

[The following was received for the record:]

QUESTION. What are the NRC resources requested for FY86 and FY87 for activities (a) required by the Nuclear Waste Policy Act of 1982 (NWPA) and (b) related to the high-level waste repository? This information should be expressed in terms of staff-years (FTEs), contractual funds, and total funds.

ANSWER.

The approximate NRC resources requested for the NWPA and for the high-level waste repository are:

	FY86			FY87		
	FTE	Contract Funds ($m)	Total* Funds ($m)	FTE	Contract Funds ($m)	Total* Funds ($m)
NWPA	156	11.3	21.8	154	14.2	25.1
HLW Repos.	133	9.9	18.8	133	11.7	21.1

*Total funds include Salaries and Benefits, Administrative Support, and Travel, as well as contract funds.

Mr. DAVIS. Yes.

Mrs. LLOYD. In these activities, I would like to look at it and I am sure the committee would also.

Mr. DAVIS. If you would like, I can break it out by nuclear waste policy activities and also high-level waste activities since there are other actions.

Mrs. LLOYD. I think that would give us a good perspective of the program. Is NRC involved in DOE's program to develop a universal spent fuel container for the storage, transportation, disposal? If so, I would like for you to explain your involvement.

Mr. DAVIS. Yes. Well, right now, the involvement is very early. We are aware this proposal has been made. I understand it comes from TVA and Westinghouse in dealing with DOE. We have met with DOE on the concepts associated with this proposal and we will continue to meet with them as we do for the disposal so that we can remain abreast of what DOE plans to do and also assure that DOE is aware of what our regulatory requirements may be. So that the regulatory requirements can be taken into effect in their planning.

Mrs. LLOYD. What is the involvement of TVA?

Mr. DAVIS. I understand it is a joint proposal from TVA and Westinghouse toward this, with regard to multiuse.

Mrs. LLOYD. What specific activities are being taken within the Nuclear Regulatory Commission relative to the MRS proposal that DOE will submit to the Congress this year?

Mr. DAVIS. Well, the act requires, of course, that we consult with DOE or DOE consults with us on the presentation of this proposal. We have had a continuing interchange with DOE on this consultation. Again, the basic drive behind this interchange is to assure that DOE is aware of our regulatory requirements maybe so that these can be considered as they develop their proposal.

In addition, however, we want to make certain that should this be authorized by Congress, we do have a regulatory umbrella in place in which we could license a MRS. We have a rule in place at the current time called 10 CFR 72 which is for full storage. But we believe it needs some modification. We will be making modifications to that rule to make it very apparent, very explicit that part 72 covers a MRS as well as other forms.

Mrs. LLOYD. We certainly would appreciate if you would keep this committee properly informed as you move——

Mr. DAVIS. Yes.

Mrs. LLOYD [continuing]. In your activities related to the MRS proposal.

Thank you very much for being our witness today. You have done a good job and we certainly appreciate it.

Our next witness is Mr. William Berry, the president and chief executive officer of the Virginia Power Co. It certainly is a very familiar face before this committee. We are delighted as well to have you with us again.

Though your written testimony is before us, it will be included in its entirety and you may summarize or just proceed as you wish. We are just delighted to have you here today.

STATEMENTS OF WILLIAM W. BERRY, PRESIDENT AND CHIEF EXECUTIVE OFFICER, VIRGINIA ELECTRIC & POWER CO., FOR THE EDISON ELECTRIC INSTITUTE, AMERICAN NUCLEAR ENERGY COUNCIL, UTILITY NUCLEAR WASTE MANAGEMENT GROUP, ELECTRIC UTILITY COMPANIES' NUCLEAR TRANSPORTATION GROUP, AND AMERICAN COMMITTEE ON RADWASTE DISPOSAL

Mr. **Berry.** Thank you, ma'am. I will just summarize, if I may. I certainly appreciate this opportunity to testify.

I am testifying on behalf of my company regarding our participation in the Department of Energy's spent fuel R&D Program under the provisions of the Nuclear Waste Policy Act. But I am also here on behalf of the electric utility and nuclear industries to comment on DOE's compliance with the statutory timetable of the act and the Department's performance in planning and analysis for the Nuclear Waste Program. All of us and the utilities particularly are closely following the implementation of the act. For several reasons it is very important to us.

First of all, the money in the Nuclear Waste Fund comes not from Government reserves but from customers of electric utilities. Second, the success of the Nuclear Waste Program is critical to the continued operation of the nuclear units now in place. And third, creation of a permanent disposal system for nuclear waste is one of the many preconditions that must be met before nuclear power will again be considered for meeting the future generation needs.

In the past year DOE recorded several noteworthy accomplishments in implementing the Nuclear Waste Policy Act. The Department's prime achievements dealt with repository site selection. DOE published criteria for selection, gave a preliminary indication of the five sites to be nominated for the first repository, and the Department indicated the preferred three sites that are expected to be recommended for site characterization.

DOE has also taken the first steps toward a proposal to be submitted to Congress for a monitored retrieval storage facility as required by the Nuclear Waste Policy Act. The MRS neither replaces a geologic repository nor detracts from the need for one. DOE's recent concept of MRS as a part of an integrated waste-handling system seems sensible. We are pleased with the appointment of Ben C. Rusche as Director of the DOE's Office of Civilian Radioactive Waste Management. One of Mr. Rusche's first moves was to begin strengthening headquarters control of the policies and functions that are implemented in DOE's field offices. We welcome this action, because the Nuclear Waste Program needs firm central management. DOE has proceeded diligently to implement the Nuclear Waste Policy Act and has addressed many of the problems we pointed to in the past. However, we continue to be concerned about the timely completion of the many steps that must be satisfied to achieve acceptance of spent fuel in 1998.

Several of DOE's accomplishments have been achieved later than specified by the schedule in the act. For example, the recommendation of three sites for characterization was supposed to have been forwarded to the President by January 1 of this year. As I mentioned, DOE indicated its preferences for three sites in the draft environmental assessments that were issued for public review and comment on December 20 of last year. However, the official recommendation will not be made until much later, probably 9 months or more late.

The Nuclear Waste Policy Act called for a specific site recommendation for the first repository in 1987. DOE has announced it will be unable to meet this deadline and will miss it by 3 years or more.

The act created both a process and a schedule and they must be regarded as equally important. Opponents will try to prolong the Nuclear Waste Program by insisting on the preeminence of process and the subordinate role of schedule.

Those of us with a strong interest in making the program work must insist on adherence to a reasonable schedule.

We are pleased that DOE has repeatedly stated its obligation to take spent fuel beginning in 1998. We are encouraged by the fact that DOE and the Nuclear Regulatory Commission have begun to work together to resolve licensing issues early in the program. However, the most impressive signs of the Government's ability to meet its commitment will be when DOE shows its ability to meet critical dates.

We have looked at DOE's proposed fiscal year 1986 budget for programs under the Nuclear Waste Policy Act, and it appears reasonable at a first reading. We intend to study the budget in detail to evaluate whether the funds are being spent efficiently and effectively.

We believe that it will be neither necessary nor appropriate to raise the program fee collected from utilities. We will look very hard at any recommendation to raise the fee in the future.

If defense wastes are included in the repository, the defense effort should pay its fair share in a timely fashion like the pay-as-you-go formula that industry is following.

As you know, the Nuclear Waste Policy Act placed responsibility for interim storage with the utilities and included provisions to help them develop the necessary means. My company's experience at our Surry power station provides an example of how this is working out. There are two nuclear units at Surry which will soon run out of storage space in its pool. Unless we have in place a licensed means for new interim storage or can transship the spent fuel to our other nuclear station, unit No. 1 at Surry will have to shut down in the fall of 1987 and unit No. 2 in the spring of 1988. A possible solution is to transship assemblies to our North Anna nuclear station. Its pool has room to take Surry spent fuel until 1992. We may have to transship some spent fuel beginning this fall, but in 1986 we hope to begin using dry cask storage instead. Dry storage casks are similar to spent fuel shipping casks and may eventually be used to ship the assemblies to the final repository. They will be stored above ground on a specially constructed concrete pad.

In October 1982, we applied to the NRC for a license for dry cask storage, which has never been used in the United States but has been carried out successfully abroad. Last March we agreed to take our dry cask storage project and make it a part of the cooperative program of research on interim storage under title II of the Nuclear Waste Policy Act. In addition to the first five casks at Surry, the demonstration involves DOE experiments on casks with our spent fuel at the Idaho National Engineering Laboratory. Virginia Power with partial support from the Electric Power Research Institute is paying 75 percent of the costs of the entire project.

DOE is funding the remainder with its appropriated R&D funds. It is essential for both the NRC to license our dry cask storage facility and for DOE to begin taking our spent fuel by this summer, if we are to avoid transshipment. Our cooperative agreement with DOE was one of two that the Department signed last year to support the research of dry techniques for interim storage. Carolina Power & Light Co., which is also facing a shortage of pool space, agreed to demonstrate storage in horizontal concrete silos. Other utilities will soon have to confront space problems. About half of them will have filled their pools before the Government takes their spent fuel beginning in 1998.

The $9 million that DOE has allocated in its fiscal year 1986 budget for spent fuel storage development will be money well spent.

We commend DOE for its accomplishments in fulfilling the process of the Nuclear Waste Policy Act, and urge the Department to give increased attention to the equally vital timetable. The technology for geological repository is relatively simple. The act allowed all of 15 years for it to be established, and provided adequate financing. Considering these favorable circumstances for Government action and the urgency of the matter, I wish to make the strongest possible plea that DOE view the critical January 31, 1998 statutory date for taking our spent fuel as absolutely essential.

I would be happy to answer any questions.

[The prepared statement of Mr. Berry follows:]

TESTIMONY OF
WILLIAM W. BERRY

PRESIDENT AND CHIEF EXECUTIVE OFFICER
VIRGINIA ELECTRIC AND POWER COMPANY
FOR THE
EDISON ELECTRIC INSTITUTE
AMERICAN NUCLEAR ENERGY COUNCIL
UTILITY NUCLEAR WASTE MANAGEMENT GROUP
ELECTRIC UTILITY COMPANIES' NUCLEAR TRANSPORTATION GROUP
AMERICAN COMMITTEE ON RADWASTE DISPOSAL
BEFORE THE
COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION
ON THE
FISCAL YEAR 1986 DEPARTMENT OF ENERGY BUDGET REQUEST
FOR THE
COMMERCIAL NUCLEAR WASTE PROGRAM
MARCH 4, 1985

Chairman Lloyd and Subcommittee members, I am William W. Berry, President and Chief Executive Officer of Virginia Electric and Power Company.

I am testifying on behalf of my company regarding our participation in the Department of Energy's spent fuel R&D program under provisions of the Nuclear Waste Policy Act.

Regarding DOE's compliance with the statutory timetable of the Act and the Department's performance in planning and analysis for the nuclear waste program, I am testifying on behalf of the Edison Electric Institute (EEI), the American Nuclear Energy Council (ANEC), the Utility Nuclear Waste Management Group (UNWMG), the Electric Utility Companies' Nuclear Transportation Group (NTG), and the American Committee on Radwaste Disposal (ACORD).

EEI is the association of investor-owned electric utility companies. Its members generate about 76 percent of the electricity in the United States.

ANEC represents over 100 organizations having an interest in nuclear power, including investor, public and cooperatively-owned utilities, manufacturers, architect-engineers, and various firms in the nuclear fuel cycle.

UNWMG is a specific activity funded by 46 utilities with nuclear programs, including EEI member companies, public utilities, and cooperatively-owned utilities. Its sole objective is to help resolve issues concerning spent fuel storage and nuclear waste disposal.

NTG represents 38 investor-owned and publicly-owned utilities. A prime objective is to provide review and comment for DOE's spent fuel transportation activities.

ACORD was formed last summer by nuclear utilities. It is a special oversight group composed of eight chief executive officers of public, cooperative, and investor-owned utilities and the TVA. We meet periodically to review the nuclear waste program and make our industry's concerns known to the Department of Energy.

Members of the groups I represent testified before Congress many times during consideration of the Nuclear Waste Policy Act and since its passage. I've been a witness several times myself on nuclear waste issues, and I'm grateful for this opportunity to testify again.

Importance of Program

All of us, and the utilities in particular, are closely following the implementation of the Nuclear Waste Policy Act because, for several reasons, it is especially important to us.

First of all, the money in the Nuclear Waste Fund comes not from government revenues, of course, but from customers of electric utilities.

For example, my company pays at the rate of over one and a half million dollars a month, which we've been collecting from our ratepayers for nuclear electricity generated since April 7,, 1983. This year we'll also make a one-time payment of $113 million for nuclear electricity we produced before then.

Utilities are paying into the fund at the rate of over $300 million a year. Annual payments will increase as more nuclear units come on line. In addition, payments for past nuclear generation will amount to $2.3 billion.

Utilities are responsible to their electricity customers for seeing that the money is well spent, and our regulatory commissions hold us accountable. For that reason, we exercise special vigor in overseeing the management of the Nuclear Waste Fund.

Second, the success of the nuclear waste program is vital to the continued operation of the nuclear units now in place.

Nuclear power now produces 14 percent of the nation's electricity. When units now being built are completed, that figure could rise as high as 20 percent.

The power that nuclear reactors generate has the lowest marginal costs and in particular the lowest fuel costs of all steam units. Utilities use nuclear plants to the greatest extent possible in meeting their customers' demand for power.

For instance, my company has four nuclear units at two stations, which supply about 40 percent of our power. In 1984, they produced electricity at only one-third the fuel cost of our coal-fired units and less than one-ninth the cost of our oil units.

It's vitally important that the nation's reactors be allowed to operate. But if any reactor reaches a point where the utility cannot ship its spent fuel or store it on site, then the unit must shut down. Loss of operating nuclear units would certainly drive up electric rates and could have damaging effects on the utilities' ability to provide reliable service.

Virginia Electric and Power Company already faces a situation that could lead to reactor shutdown unless appropriate action is taken soon. The spent fuel pool at our Surry nuclear station will be the first in the country to run out of room. I'll discuss that situation and the development of new means of interim storage later in my testimony.

We cannot continue indefinitely to accumulate spent fuel in power station pools or other interim storage. To avoid the risks of needless and costly losses of service by existing units, a permanent disposal system for nuclear waste must be created in the time frame established by the Act.

Third, creation of a permanent disposal system for nuclear waste is one of the many preconditions that must be met before nuclear power will again be considered for meeting future generation needs.

By the year 2000, America is likely to need at least 100 to 200 million kilowatts of generating capacity in addition to the power plants now in place and under construction.

Last month, the Edison Electric Institute issued a special report on nuclear power. It declared that no utility would now choose nuclear power because of the risks and uncertainties involved, unless comprehensive reforms were implemented to remove the institutional and regulatory impediments.

The report concluded that, with substantial improvements in the way nuclear power is managed and governed, it could again be a low cost option. This was formerly the case in this country and is still so in many other countries.

We believe it's in the national interest to take actions that will again make nuclear power an option American utilities can consider to meet future capacity needs. Timely actions to assure permanent disposal are essential to achieve that objective.

Implementing the Nuclear Waste Policy Act

Since the difficulties in creating a repository are primarily institutional rather than technical, passage of the Nuclear Waste Policy Act went a long way toward establishing the confidence of industry in the country's waste program.

The Act was a landmark achievement, culminating years of effort to develop a firm statutory basis for a successful program. But we recognized two years ago that enactment was just the first step, and that successful implementation would prove equally challenging.

The nuclear waste program tests the ability of government to carry out an exceedingly complex mission over a long period of time while dealing with forces that arise to oppose nearly every action.

Against that background, DOE's accomplishments are noteworthy.

The Department's prime achievements in the past year dealt with repository site selection. DOE published the criteria for selection and gave a preliminary indication of the five sites to be nominated for the first repository. The Department indicated the preferred three sites that are expected to be recommended for site characterization.

Site selection is clearly both the backbone of the Act and its most politically troublesome aspect. We are pleased that DOE is proceeding with the difficult issues of permanent geological disposal. DOE must resolve to complete the site selection process so that the site characterization process can begin.

DOE has also taken the first steps toward a proposal to be submitted to Congress for a Monitored Retrievable Storage facility, as required by the Nuclear Waste Policy Act. The Department has selected two alternative design concepts and initiated design work. If the MRS facility is approved by Congress, it may become an integral part of the final geological repository program. The MRS neither replaces a geological repository nor detracts from the need for one.

DOE's recent concept of MRS as part of an integrated waste handling system seems sensible. The Department is considering the use of an MRS as a facility to receive and package spent fuel in preparation for final disposal in a geological repository. This arrangement could contribute to efficiency, particularly if it permits reduction in the volume of wastes and a consequent reduction in shipment-miles as spent fuel travels from reactors to repository.

We are pleased with the appointment of Ben C. Rusche as director of DOE's Office of Civilian Radioactive Waste Management. Mr. Rusche brings a great deal of talent and experience to the position.

One of Mr. Rusche's first moves was to begin strengthening headquarters control of the policies and functions that are implemented in DOE's field offices. We welcome this action because the nuclear waste program needs firm central management.

DOE has proceeded diligently to implement the Nuclear Waste Policy Act, and has addressed many of the problems we've pointed to in the past. However, we continue to be concerned about the timely completion of the many steps that must be satisfied to achieve acceptance of spent fuel in 1998.

Meeting the Schedule

Several of DOE's accomplishments have been achieved later than specified by the schedule in the Act.

The recommendation of three sites for characterization was supposed to have been forwarded to the President by January 1 of this year. As I mentioned, DOE indicated its preferences for three sites in the draft environmental assessments that were issued for public review and comment on December 20 of last year. However, the official recommendations will not be made until much later -- probably nine months or more late.

The Nuclear Waste Policy Act called for a specific site recommendation for the first repository in 1987. DOE has announced that it will be unable to meet this deadline, and will miss it by three years or more.

We hope that the mission plan scheduled for completion in May will not be further delayed. It's also important that another key planning document that's been delayed, the project decision schedule, be issued in final form at the earliest possible date.

The question of how any particular overdue item affects the 1998 deadline can be argued at great length. But it's the cumulative effect of delays early in the program that worries us. If the early decision milestones are not reasonably maintained, then the end date of January, 1998, cannot likely be fulfilled.

The schedule is a significant component of the Nuclear Waste Policy Act. Decision-making in nuclear waste management is the kind of activity that people like to put off, particularly because there's no immediate crisis that forces decisions to be made. Without the discipline of the schedule, the program would be subject to the forces of drift and delay that prevailed before the Act.

The Act created both a process and a schedule, and they must be regarded as equally important. Since the Act was passed, DOE has been paying great attention to process and emphasizing extreme thoroughness, as in the ten thousand-plus pages of environmental assessments for the repository candidate sites.

Opponents will try to prolong the nuclear waste program by insisting on the preeminence of process and the subordinate role of schedule. Those of us with a strong interest in making the program work must insist on adherence to a reasonable schedule.

We were pleased that DOE has repeatedly stated its obligation to take spent fuel beginning in 1998. But we would rather not test the government's ability to keep that pledge. The commitment will be impressively convincing when DOE shows its ability to meet critical dates.

Our confidence in the firmness of the schedule is strengthened by the fact that DOE and the Nuclear Regulatory Commission have begun to work together in a cooperative way to resolve licensing issues early in the program. NRC should work with DOE during site characterization to settle matters that otherwise would wait until the Commission's formal review of the license application. Much of this necessary review might thus be done even before DOE applies for a license.

General Comments

I'd like to comment on several other matters, beginning with the budget.

* The Department's proposed fiscal 1986 budget for programs under the Act appears reasonable at a first reading. The large increase of 74 percent over fiscal 1985 may be appropriate because of DOE's large expenditures. The

Department is starting extensive repository site characterization, an expanded effort in transportation, and development of an integrated system approach that includes an MRS. We intend to study the budget in detail to evaluate whether the funds are being spent efficiently and effectively.

* We believe that it will be neither necessary nor appropriate to raise the program fee collected from utilities.

The recent Fee Adequacy Report prepared by DOE indicates no increase for the time being. We will look very hard at any recommendation to raise the fee in the future.

* If defense wastes are included in the repository, the defense effort should pay its fair share of the costs in a timely fashion, like the pay-as-you-go formula that industry is following. Deferral of defense payments would place an undue burden on the civilian program.

As you know, the Act requires a shared repository unless the President decides otherwise. We understand that he will soon make that decision

Transportation Casks

* We urge that spent fuel transportation casks be built based upon a complete systems analysis of transportation requirements for the total integrated waste management system.

DOE recently issued a publication titled "Transportation Business Plan: Strategy Options Document." The report stresses active government involvement in development of shipping casks and transportation systems services.

However, while DOE involvement is essential, we would urge that the Department's primary role be in issuing performance specifications for cask procurement and shipping services that would allow maximum involvement of the expertise available in the private sector. This is consistent with the provision of the Act calling for maximum industry involvement.

There are a variety of utility needs for different types of casks. For example, some utilities would prefer combined storage/transport casks. Others could use simpler casks. To serve all the various needs, the federal government should permit the use of existing serviceable casks.

Interim Storage

As you know, the Nuclear Waste Policy Act placed responsibility for interim storage on the utilities, and included provisions to help them develop the necessary means. My company's experience at our Surry power station provides an example of how this is working out.

There are two nuclear units at Surry. Unit 1 went into operation in 1972, and unit 2 followed in 1973.

After we refuel unit 1 early next year and place the spent fuel in the pool, there will no longer be room in the pool to hold all the assemblies from either unit. This loss of full core discharge capability is not a safety consideration. But it would prevent us from unloading all the assemblies from either Surry unit for special maintenance that's required every so often.

When we refuel the other Surry unit late next year and place its assemblies in the pool, no room will be left for any more spent fuel. Unless we have in place a licensed means for interim storage or can transship the spent fuel to our other nuclear station, the units will have to shut down when the fuel in their core then is exhausted. This would happen to unit 1 in the fall of 1987, and unit 2 in the spring of 1988.

Loss of the two Surry units would increase customer costs by hundreds of millions of dollars a year. Clearly, the spent fuel issue is a major concern for Virginia Electric and Power Company.

Nuclear plants were built with the idea that spent fuel would be removed within a reasonable time period. The Nuclear Waste Policy Act made it clear that we had to provide more interim storage than we had originally planned, since it requires utilities to store spent fuel until a permanent repository is available.

We don't have time to license and build a new pool, which would take at least seven or eight years. Nor can we again put in new racks that allow for closer packing of assemblies in the Surry pool, because the structure won't bear the added weight.

Transshipping Spent Fuel

A possible solution is to transship up to 500 assemblies to our North Anna nuclear station some 150 miles by road. Its pool has room to take Surry spent fuel until 1992. Of course, if no other means of interim storage has become available by then, both plants would have to shut down. Without spent fuel from Surry, North Anna would run out of room in 1998.

But transshipment obviously doesn't solve the fundamental problem -- it only postpones the day of reckoning. And it's the most politically sensitive option. We may have to transship some spent fuel beginning this fall, but in 1986 we hope to begin using dry cask storage instead.

Dry storage casks are similar to spent fuel shipping casks and may eventually be used to ship the assemblies to the final repository. We expect to buy three casks a year on the average. They will be stored above ground on a specially constructed concrete pad.

In October, 1982, we applied to the NRC for a license for dry cask storage, which had never been used in the United States, but was being carried out successfully abroad.

Title II Research

Last March we agreed to make our dry cask project part of the cooperative program of research on interim storage under Title II of the Nuclear Waste

Policy Act. In addition to the first five casks at Surry, the demonstration involves DOE experiments on casks with our spent fuel at the Idaho National Engineering Laboratory.

DOE will test the limits of the casks; attempt to use air instead of an inert atmosphere inside the casks; and try storage of spent fuel rods that have been removed from the assemblies and consolidated. Virginia Electric and Power Company, with partial support from the Electric Power Research Institute, is paying 75 percent of the costs for the entire project. DOE is funding the remainder with appropriated R&D funds.

There is no opposition to dry cask storage at Surry, and the storage structure is not elaborate, so we had hoped that the facility would have been licensed over a year ago. It will take a year to build.

We had also hoped that DOE would have started taking our spent fuel and begun research last summer. They'll take 144 assemblies, about equal to the number that goes into the pool from two refuelings.

It's essential for both NRC to license our dry cask storage facility and DOE to begin taking our spent fuel by this summer if we are to avoid transshipment.

Our Cooperative Agreement with DOE was one of two that the Department signed last year to support research on dry techniques for interim storage. Carolina Power and Light Company, which is also facing a shortage of pool space, agreed to demonstrate storage in horizontal concrete silos.

Other utilities will soon have to confront space problems. About half of them will have filled their pools before the government takes their spent fuel beginning in 1998. It's crucial to demonstrate new means of interim storage soon. The $9 million that DOE has allocated in its fiscal 1986 budget for spent fuel storage development will be money well spent.

NRC can also help through the procedures it establishes to carry out Section 134 of the Nuclear Waste Policy Act, which was expected to expedite the licensing of interim storage operations and facilities. This provision will be most important as utilities adopt new means to store spent fuel. NRC is deliberating now on how to discharge its Section 134 responsibilities. We hope that the outcome will be consistent with the spirit of the Act.

Criticality of 1998 Date

We commend DOE for its accomplishments in fulfilling the process of the Nuclear Waste Policy Act, and urge the Department to give increased attention to the equally vital timetable.

The technology for a geological repository is relatively simple, the Act allowed all of 15 years for it to be established, and adequate financing has been provided. Considering the favorable circumstances for government action and the urgency of the matter, we wish to make the strongest possible plea that DOE view the critical January 31, 1998 statutory date for taking our spent fuel as absolutely essential.

Thank you.

Mrs. LLOYD. Thank you, Mr. Berry. I think we are going to have to recess for a vote, and we will be right back for questions and we beg your indulgence. These are necessary processes that I am sure you are acquainted with.

[Recess.]

Mrs. LLOYD. The subcommittee will resume its hearing.

Mr. Berry, there are some questions we basically want you to answer for the record.

If you would, describe a little further the utility industry involvement in auditing the performance of DOE.

Mr. BERRY. The utility industry formed a group of nuclear utilities, including the publicly owned, cooperatively owned, and investor owned utilities, as well as the Tennessee Valley Authority.

This oversight group, which consists of eight chief executive offices, and I am one, is the American Committee on Radioactive Waste Disposal, rad waste disposal, which we call ACORD; everything has to spell something.

We meet periodically to review the DOE progress and where the money is being spent and where we think they are making adequate progress. Then we convey our views to the Department of Energy and I think in some cases we have been able to provide them with some assistance in resolving issues.

But basically we are to monitor and then be sure our customers' money is well spent. And for my company, that is $1½ million a month, so it's an important item to the industry.

Mrs. LLOYD. So you really have a real interest in that program for more than one reason. Are you really satisfied that industry is doing enough to monitor the DOE and provide comments to the Congress as well in supervision of the program?

Mr. BERRY. I am. I think it's a delicate line between preaching and meddling, and I think we don't want to get so that we are a hindrance to DOE's action. We want to be supportive. We want to tell them when they are wrong, we will certainly tell them that, but we don't want to get too deeply into their business.

So I think we have tried to strike that right balance.

Mrs. LLOYD. You think you have a good balance at the present time. And, of course, I think you are more financially involved than any other utility in this program; is that not correct?

Mr. BERRY. Yes, we are. About 40 percent of our energy comes from nuclear power, so we are large current contributors. We started early, back in 1972, so we have a lot of spent fuel.

Mrs. LLOYD. Aren't you a little bit more involved also in the review process?

Mr. BERRY. Yes. There are several other groups aside from this oversight group that look at specific issues like transportation, and we are involved in all of those groups as well.

Mrs. LLOYD. On page 7 of your testimony, I know that you indicated that progress and schedule are equally important. Would you tell the subcommittee why you believe the schedule is so important.

Mr. BERRY. I can think of about four reasons. The first one is that the 1998 date is the date we are planning on as an industry. We are taking the steps necessary to provide the storage as mandated by the law until 1998. It would be wasteful for us to spend money to provide storage beyond 1998 if the Government is going to live up the the act.

If somewhere in the process that schedule slips, then we will not have provided the facilities beyond 1998, and we will find ourselves in a crisis mode.

Mrs. LLOYD. That is why you feel it is so important that they meet the deadlines for its activities as was specified by the Nuclear Waste Policy Act of 1982.

Mr. BERRY. That is correct, and they have already missed some. And they may not be crucial as far as finally meeting the 1998 date, but it does not give you a very comfortable feeling to look at the track record. We would like to see them meet some dates and then maybe we would have a little more confidence.

Mrs. LLOYD. Aren't there other reasons as well?

Mr. BERRY. Sure, there are. And I think these early dates, as the DOE pointed out, it's important to do it right up front, but I think we also will feel better when they start meeting their targets. But the date is crucial to us in terms of cost for what it would cost us to provide the storage if the DOE does not.

We have already paid for it, and if DOE doesn't provide it, then we would have to provide it.

Mrs. LLOYD. You are going to be paying twice.

Mr. BERRY. We will be paying twice. We will be generating about 2,000 tons of waste a year in 1998. If you put that in dry casks, which is the approach we are interested in, that is about 10 tons of casks, that is 200 casks a year the industry would have to buy, and my guess is it will cost about $1 million.

Now they certainly cost more than that. That is a lot of money to duplicate what we have already paid for.

Mrs. LLOYD. That is a tremendous expenditure for the ratepayers that feel thay they are sufficiently oppressed at the present time, which I am sure you are very much aware of.

Mr. BERRY. Then there is the problem if you are unable to get it licensed or get it purchased in time, then you face the shutdown of units which can cost $100 million a year per unit, and there are some seven operating in the United States today.

Mrs. LLOYD. We can certainly see the urgency.

Turning to another area, do you think that DOE is giving sufficient attention to the development of a universal container for the spent fuel storage and the transportation and disposal?

Mr. BERRY. They are certainly looking at it, as is the NRC. We think the dry cask that we will employ at Surry is suitable for transportation as well as interim storage. It's a German cask and they use it for both purposes. We are a little concerned in the business plan that DOE prepared that they seem to be taking the approach that no cask research had already been done, and yet there are a lot of casks that are already in operation in this country and abroad.

It's not a new technology. It's a well-established technology and we need to build on what we already know rather than reinventing the wheel.

Mrs. LLOYD. That is very good.

I took it from your testimony that you don't think it would be a very good idea increasing the 1 mill/kilowatt-hour fee.

Mr. **Berry**. I don't think there is any basis for doing that today. We are paying in the next fiscal year, we will be paying, we, our customers, will be paying through us to the Federal Government about $400 million more than they are spending, so we are making a substantial contribution to closing the deficit.

It seems to me that that is enough, and that the big uncertainty is what is inflation going to be for the next 20 years. And nobody has any idea what that is going to be, so it would be sheer speculation to change the fee now.

Mrs. **Lloyd**. Thank you.

Mr. Morrison.

Mr. **Morrison**. Thank you, Madam Chairman.

Mr. Berry, I have enjoyed your comments. You are representing a number of groups, and perhaps at least one of my questions will relate to the attitude of more than just yourself, personally.

Timetable is obviously very important to you. You have made that point very well and I am inclined to agree, even though with the facility, one of the facilities proposed in my own backyard I have some sensitivity to allowing adequate time for comment. But I too am one of those that will want a balance between the process and the schedule.

I am delighted that you have supported the concept of a coordinated monitoring retrievable storage. Could that, if possible, if need be, give a little space in the time sequence, give you a little breathing room in case we are delayed in the final selection of a high-level waste repository or a combination of them?

Mr. **Berry**. I think my answer would be that the technical answer to that is yes, the MRS could provide breathing time if you miss 1998. I think I would immediately follow and say the political answer to that, in my judgment, is no. That if MRS is viewed as a substitute for the permanent geological repository, we may never get the repository. But technically it would provide some cushion.

Mr. **Morrison**. I guess I certainly would not agree with MRS as a substitute, but I have seen in the few years I have been here a shift in attitude and MRS now seems to be a different, almost a collection point, if you will, for the shipment of spent wastes to the final repositories.

So I appreciate the industry's viewpoint on that.

We have heard a little earlier about coordination between the Department of Energy and the Nuclear Regulatory Commission and establishing some guidelines and some agreements. As the industry views it, has that process been satisfactory?

Mr. **Berry**. I think we would say as far as the review of the criteria and environmental assessment, it was slower that we would have liked to have seen it, but the job got done, and it seems to me that coordination worked very well. The jury is still out as far as the cask, both the interim storage and the transshipment cask. There is dialog going on between DOE and the Department of Energy, but as of this moment we don't have alliance, and so I could not say that the process is perfect; it's too slow.

Mr. **Morrison**. Let me throw you a curve ball, the issue of liability, which is going to appear particularly at the request of the States; that is, who is liable? Obviously, the Federal Government is, but to what extent?

Should it fit under the Price-Anderson Act, which in the eyes of many it won't? Has the industry discussed this, because ultimately you will pick up the tab again for liability, and I am very interested in your reaction to this.

Mr. **Berry**. The industry has discussed it. There is a group that is really focusing on the Price-Anderson Act and will urge its renewal, and one of the reasons we think it should be renewed is to deal with the specific issue you are raising, that it would provide an assurance of the prompt recovery in the event that some liability occurred in the repository. So there is a mechanism, and if it is not clear that the Department of Energy is covered by that act, then it should be made clear when the act is renewed.

We think that the Price-Anderson provides an efficient mechanism for paying any claims that might arise, and we think this process, the permanent repository, ought to be covered by that act.

Mr. **Morrison**. Thank you very much, Mr. Berry.

Thank you, Madam Chairman.

Mrs. **Lloyd**. Going back to oversight, Mr. Berry, will EEI be forming a group to visit the repository sites to evaluate or examine the characterization work that is being undertaken?

Mr. **Berry**. ACORD will. EEI represents only investor-owned companies, and this is not an issue that applies only to investor-owned companies. It applies to the Tennessee Valley Authority and municipally owned and cooperatively owned utilities as well. ACORD takes all of it.

Mrs. **Lloyd**. As a mechanism, but EEI will be in front.

Mr. **Berry**. But we will be sending teams to the sites to monitor the progress of the field office and again we have tried to develop that site, onsite, oversight in a way that does not burden the Department of Energy, but provides us with the information we need.

Mrs. **Lloyd**. Now some Members of Congress have proposed that the Department of Energy select copper as a container material for the spent fuel that it placed in the repository. They feel this would help the copper industry in the United States, which is apparently in a very critical state at the present time, and would allegedly provide a longer containment time for the spent fuel.

What do you think of the copper containers?

Mr. **Berry**. The copper container may be suitable in some environments and completely unsuitable in other environments. I don't think you can categorically say it is going to give longer life. In some environments it would be worse in terms of life. As I understand, the Swiss use a copper container, but it is a very, very thin copper container. I doubt it would make much contribution to the copper industry.

There is a proposal floating around the United States for a very thick copper container, and I am sure it would do a lot for the copper industry. But I think the choice ought to be made on the basis of safety and cost, and if copper wins out on the basis of safety and cost, then it ought to be chosen.

I don't think our customers want to subsidize the copper industry. If it is not the cheapest and the safest then we don't want to buy it.

Mrs. **Lloyd**. Do you think that the Department needs to be doing more to demonstrate the dry storage technologies than it is presently doing?

Mr. **Berry**. Well, since we have a contract with them, I think what they are doing is fine.

Mrs. **Lloyd**. You think it's fine.

Mr. **Berry**. We would like for them to move a little faster on the dry cask front as well as the implementation of the act. But we think the programs they have laid out for dry cask research are good ones.

Mrs. **Lloyd**. Do you think that they should generically approve these dry storage technologies; for instance, you think they should approve the one you are demonstrating with DOE?

Mr. **Berry**. I think it would be NRC that would generically approve it.

Mrs. **Lloyd**. Pardon me. The one working with DOE?

Mr. **Berry**. And we think it ought to be generically approved both for storage and shipment and the cask is certainly suitable for both. The Germans use it for both, and I ought to add we will not just be using a German cask, we will be using casks built in this country as well.

But it certainly has been proven that shipment and storage can be done with the same cask.

Mrs. **Lloyd**. Thank you very much.

Mr. Stallings?

Mr. **Stallings**. No questions.

Mrs. **Lloyd**. Any further questions?

Mr. Monson.

Mr. **Monson**. No.

Mrs. **Lloyd**. Well, thank you again, Mr. Berry, for your very excellent testimony, and we look forward to hearing from you in the future as well.

Mr. **Berry**. Thank you, Ma'am.

Mrs. **Lloyd**. Our next witness is Mr. Robert Broadbent, with the Interior Department, and he will tell us how the Interior Department Agency is intended to interact with the Department of Energy on the waste program.

We are happy to have you here with us, Mr. Broadbent. We have your testimony. You may proceed as you wish, and your entire statement will be made a part of the record.

STATEMENT OF ROBERT N. BROADBENT, ASSISTANT SECRETARY FOR WATER AND SCIENCE, DEPARTMENT OF THE INTERIOR

Mr. **Broadbent**. Thank you very much, Madam Chairwoman and members of the committee.

I am pleased to be able to appear before the subcommittee to talk about the activities of the Department of the Interior in the Nation's High-Level Nuclear Waste Management Program, especially as they relate to the Nuclear Waste Policy Act of 1982.

Even before passage of the Nuclear Waste Policy Act, the bureaus in our Department were involved in support of the Department of Energy's site screening and characterization programs.

Two bureaus, the U.S. Geological Survey and the Bureau of Mines, directly support the DOE and the Nuclear Regulatory Commission in the national program for disposal of civilian high-level radioactive waste.

Our other bureaus have been and will continue to be involved, generally within their normal management responsibilities, as the issues related to wildlife, parks, natural resources and Federal and Indian lands. Their input to the program will come largely through review of various DOE documents, such as the recently released environmental assessments of nine potential repository sites.

Review of the environmental assessments is coordinated by our Office of Environmental Project Review, which consolidates all bureau comments into a single Department position. By far the largest contribution by Interior bureaus is that of the USGS, whose activities include support and advice in all areas of geology and hydrology.

This effort involves the active and continuous participation of more than 100 USGS employees, 85 of whom are involved at the Yucca Mountain, NV, site. As required by the act, the USGS consult with the DOE in the preparation of the General Guidelines for the Recommendation of Sites for Nuclear Waste Repositories—10 CFR 960—and concurred in the final version of the guidelines published in December of last year.

Scientists from the USGS assisted the DOE in this process by serving as panel members at public hearings to receive comments on the guidelines.

The USGS also conducts specific site and aerial studies for the DOE and provides a variety of review and advisory services. USGS field studies for the DOE include the following:

The lead role in characterizing the geologic and hydrologic conditions of the Yucca Mountain site and vicinity in Nevada;

Participation in and review of geologic and geophysical studies of the Paradox Basin bedded salt site in southeastern Utah, which is one of the five originally nominated sites;

Technical reviews, in response to DOE request, of geologic and hydrologic interpretations of potential repository sites at the Hanford Reservation, WA, and at the various sites under consideration in salt environments.

Other important USGS activities in the DOE program are:

Critical reviews of regional geologic reports for the crystalline rock site screening program in the Eastern United States;

Development and application of geophysical characterization techniques to potential sites;

Independent advice and suggestions on a variety of other Earth science issues;

Participation in a formal USGS-DOE coordination committee which meets quarterly.

Although the provisions of the act do not modify the traditional USGS role in the collection, analysis, and dissemination of Earth science information, the act clearly accelerates the need for USGS, the BLM, and others to provide a large amount of site-specific information.

The USGS has responded to this need by modifying its internally funded research program to provide a large amount of Earth science information on a variety of potential geohydrologic environments, as well as to provide more direct assistance to the DOE mission.

In fiscal years 1986 and 1987, the level of activity of the USGS is expected to increase somewhat as exploratory shafts are constructed at three potential sites for the first repository and site-screening activities for the second repository proceed to more detailed levels.

The greatest level of USGS activity will continue to be at the Nevada test site where the complex problem of water flow in the unsaturated zone will be addressed by an innovative program of research.

The BLM has also devoted a considerable amount of resources to the DOE program. Their efforts have been directed to generic research in mine design and rock mechanics. As an example, during fiscal year 1985, the BLM has provided technical assistance to both the DOE and the NRC in support of their site screening and characterization efforts.

The major support for NRC has been in the review of contractors' proposals in the rock mechanics area and in support of the reviews of the environmental impact. This has involved the full-time support of six professionals. The BLM has supported the DOE Waste Isolation Pilot Plant [WIPP] project by the drilling of test holes and installation of instruments for their site characterization study.

In addition, technical and support service has also been provided. In fiscal years 1986 and 1987, the BLM expects to increase the level of activity in relation to the mining that will be associated with site characterization. The degree of increased activity and the problems to be addressed are being negotiated, and a decision is expected soon.

With regard to the subcommittee's inquiry about the need for an additional organization to coordinate DOI activities under the act, I see no need at this time for such an organization. By far the greatest amount of activity in the DOI is carried out by the USGS, which has a memorandum of understanding with the DOE and coordinates its activities with those of the DOE through a number of formal and informal arrangements.

All of the concerned DOI bureaus have representativies on the DOI's Committee on Interagency Radiation Research and Policy Coordination which provides a very useful avenue for any coordination that is necessary.

Madam Chairman, we are all working well with the DOE at this time, and we are doing everthing we can to meet the objectives with regard to disposing of the Nation's high-level nuclear waste. The DOI is committed to do its best in responding to its part of those challenges mandated by the act.

We will be happy to answer any additional questions the subcommittee may have regarding our role in the national program or our work on specific Earth science issues relative to repository site selection.

Thank you. That concludes my statement.

[The prepared statement of Mr. Broadbent follows:]

TESTIMONY OF
ROBERT BROADBENT, ASSISTANT SECRETARY FOR WATER AND SCIENCE
DEPARTMENT OF THE INTERIOR
BEFORE THE
SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION
COMMITTEE ON SCIENCE AND TECHNOLOGY
U. S. HOUSE OF REPRESENTATIVES

March 4, 1985

Madame Chairwoman, I am pleased to have the opportunity to tell this Subcommittee about the activities of the Department of the Interior (DOI) in the Nation's high-level nuclear waste management program, especially as they relate to the Nuclear Waste Policy Act of 1982.

Even before passage of the Nuclear Waste Policy Act, the bureaus in our Department were involved in support of the Department of Energy's (DOE) site screening and characterization programs. Two bureaus, the U.S. Geological Survey (USGS) and the Bureau of Mines (BOM) directly support the DOE and the Nuclear Regulatory Commission (NRC) in the national program for disposal of civilian high-level radioactive waste. Our other bureaus have been and will continue to be involved, generally within their normal responsibilities, as the issues relate to wildlife, parks, natural resources, and Federal and Indian lands. Their input to the program will come largely through review of various DOE documents, such as the recently released environmental assessments of nine potential repository sites. Review of the environmental assessments is coordinated by our Office of Environmental Project Review, which consolidates all bureau comments into a single Department position.

By far the largest contribution by Interior bureaus is that of the USGS whose activities include support and advice in all areas of geology and hydrology. This effort involves the active and continuous participation of more than 100 USGS employees, 85 of whom are involved at the Yucca Mountain, Nevada, site. As required by the Act, the USGS consulted with the DOE in the preparation of the General Guidelines for the Recommendation of Sites for Nuclear Waste Repositories (10 CFR Part 960) and concurred in the final version of the Guidelines published in December of last year. Scientists from the USGS assisted the DOE in this process by serving as panel members at public hearings to receive comments on the Guidelines.

The USGS also currently conducts specific site and areal studies for the DOE and provides a variety of review and advisory services. USGS field studies for the DOE include the following:

- the lead role in characterizing the geologic and hydrologic conditions of the Yucca Mountain site, and vicinity, in Nevada;
- participation in and review of geologic and geophysical studies of the Paradox Basin bedded-salt site in southeastern Utah, which is one of the five originally nominated sites;
- technical reviews, in response to DOE requests, of geologic and hydrologic interpretations of potential repository sites at the Hanford Reservation, Washington, and the various sites under consideration in salt environments.

Other important USGS activities in the DOE program are:

- critical reviews of regional geologic reports for the crystalline rock site screening program in the eastern United States;
- development and application of geophysical characterization techniques to potential sites;
- independent advice and suggestions on a variety of other earth-science issues;
- participation in a formal USGS/DOE Coordination Committee which meets quarterly.

To insure full coordination with the DOE, the USGS has three full-time employees on site with the DOE.

- one full-time liaison position is at Columbus, Ohio, and one at DOE Headquarters, Washington, D.C.;
- one USGS hydrologist has been assigned to DOE Headquarters in a continuous advisory position.

Although the provisions of the Act do not modify the traditional USGS role in the collection, analysis, and dissemination of earth-science information, the Act clearly accelerates the need for USGS, the BOM, and others to provide a large amount of site-specific information. The USGS has responded to this need by modifying its internally funded research program to provide a large amount of earth-science information on a variety of potential geohydrologic environments, as well as to provide more direct assistance to the DOE mission.

In Fiscal Years 1986 and 1987, the level of activity of the USGS is expected to increase somewhat as exploratory shafts are constructed at three potential sites for the first repository and site-screening activities for the second repository proceed to more detailed levels. The greatest level of USGS activity will continue to be at the Nevada site where the complex problem of water flow in the unsaturated zone will be addressed by an innovative program of research.

The BOM has also devoted a considerable amount of resources to the DOE program. Their efforts have been directed to generic research in mine design and rock mechanics. As an example, during Fiscal Year 1985, the BOM has provided technical assistance to both the DOE and the NRC in support of their site screening and characterization efforts. The major support for NRC has been in the review of contractors' proposals in the rock mechanics area and in support of the reviews of the environmental impact. This has involved the full-time support of six professionals. The BOM has supported the DOE Waste Isolation Pilot Plant (WIPP) Project by the drilling of test holes and installation of instruments for their site-characterization study. In addition, technical and support service has also been provided. In Fiscal Years 1986 and 1987, the BOM expects to increase the level of activity in relation to the mining that will be associated with site characterization. The degree of increased activity and the problems to be addressed are being negotiated, and a decision is expected soon.

With regard to the Subcommittee's inquiry about the need for an additional organization to coordinate DOI activities under the Act, I see no need at this time for such an organization. By far the greatest amount of activity in the DOI is carried out by the USGS, which has a Memorandum of Understanding with the DOE and coordinates its activities with those of the DOE through a number of formal and informal arrangements. All of the concerned DOI bureaus have representatives on the DOI's Committee on Interagency Radiation Research and Policy Coordination which provides a very useful avenue for any coordination that is necessary.

Madame Chairwoman, we are all working well with the DOE at this time, and we are doing everything we can to meet the objectives with regard to disposing of the Nation's high-level nuclear waste. The DOI is committed to do its best in responding to its part of those challenges mandated by the Act. We will be happy to answer any additional questions the Subcommittee may have regarding our role in the national program or our work on specific earth-science issues relative to repository site selection.

Thank you. That concludes my statement.

Mrs. Lloyd. Thank you very much, Mr. Broadbent. We are happy to know you are working well with the Department of Energy.

Do you have any criticism of the way DOE has conducted its site selection process for the repositories?

Mr. Broadbent. No. I don't have any specific criticism. I have to tell you that my home State is Nevada, and I have had more than a passing interest, as has Mr. Morrison maybe because of his State and Hanford, in the work.

I have had an opportunity to tour several of the sites with the Department of Energy and with the U.S. Geological Survey and have had many meetings with Mr. Rusche, the Director, and his people, and the Director, as we discuss the involvement of the USGS and other bureaus within the Department of the Interior.

I think we all have the frustrations of not seeing things move as fast as we would like, and some things like that. But in general I would have to say we have good cooperation from the Department of Energy.

Mrs. Lloyd. We are certainly happy to hear it, especially from your perspective.

Mr. Broadbent, have you looked at the Department of Energy's draft project decision schedule?

Mr. Broadbent. Some of our people have looked at that schedule, have commented on the schedule, and I think we pretty generally support the schedule that is there.

Mrs. Lloyd. Thank you very much.

Mr. Morrison. Thank you, Madam Chairman.

I might have to catch myself a couple of times because I am so used to Bob Broadbent as the Commissioner of Reclamation, and I think we are back on warm water irrigation on this issue.

Mr. Broadbent. It seems a little different.

Mr. Morrison. It certainly does. USGS was rather critical of some of the processes reported by the Department of Energy in the environmental assessment of the Hanford site. And I was wondering if you had any more recent information, not on correcting their objections, but on the process.

Do you sense there is a better working relationship now that we have reached the plateau that we have, and is the Department of Energy at Hanford utilizing or leaning more on USGS personnel, particularly as it comes to the hydrological approach and problem there?

Mr. Broadbent. Yes to your last question. I think definitely the Department of Energy is leaning on the USGS. Remember that the site characterization at the Hanford site was done by an outside contractor, and it is not like the Nevada site where USGS actually had the lead responsibility.

I am aware of the comments made by the scientists from the U.S. Geological Survey commenting on the Hanford site. Those same comments, incidentally, in essentially the same way, were made to the Department of Energy in about May 1983. And a paper, an unpublished paper, was later done by Dr. White in the summer of that year as it pertained to that Hanford site.

We feel that there is a knowledge, there is a working relationship, there is still a concern, and I think that is how it ought to be with scientists. I am not a scientist, but I think our responsibility should be able to leave those people to comment as they see fit on the science of the activities and for us to be able to respond and to give them the support they need to be able to do their work.

And I think that is particularly true as you look at the site characterization on all of the sites. We have to let the technical people do their work, and I feel that is being done. I think they are interested and they are listening. They know what scope of studies have to be done after the sites are picked and work goes on in the next 4 or 5 years.

And I think there is a general anticipation that that work will follow through and be done right.

Mr. MORRISON. I certainly hope that is the case, and I just want to make sure that your people feel like they have complete access to everything that is going on, which perhaps was at times denied them when working through a separate contractor.

Mr. BROADBENT. I think that is clear. Mr. Rusche has told me a number of times that our people have complete access to everything, that if it's going to be our responsibility as scientists to comment, which it is for the Bureau of Mines and USGS, then we certainly have to have access to all of the information. They have to be willing to listen, and I feel that is happening.

Mr. MORRISON. How important to you is the water issue? Nevada, for instance, is a dry site. Does that automatically make it more attractive for long-term disposition than does a potentially wet site?

Mr. BROADBENT. Well, I don't think so. As it has been explained to me, the Nevada site is a dry site because you don't go through a water layer on the way to where you are going to, to where the repository is going to be.

In the case of Washington or in the case of the Texas site, for instance, you actually have to go through a water layer to get down into the area where you want to actually put the nuclear repository waste site.

I think we are worried about how toxics might move through the water. And the hydrology of the structure would indicate whether it might fracture and water might move through that structure, and I think that is important at either site or at any of the sites. Certainly the bulk of the work or a good part of the work that is being done by USTGS is in the area of water hydrology and the movement of water through that surface area or subsurface area.

Mr. MORRISON. Thank you.

Does Interior have specific criteria that they use in judging whether an Indian tribe's interests are affected by the potential siting of a repository?

Mr. BROADBENT. Yes, and it comes from section 22(B) of the act, and it said:

> To be certified, a Tribe must have possessory or usage rights to land outside its reservation boundaries which arise out of congressional ratified treaties, and the Secretary must find that such rights may be both substantially and adversely affected by the location of a nuclear waste on or near these lands.

Then we must notify, Energy must be notified in writing on this certification, so we do have a direct responsibility to the tribes.

And this is done through the Bureau of Indian Affairs, which has the trust responsibility for the tribes.

Mr. MORRISON. You have turned down some tribes.

Mr. BROADBENT. Yes; yes.

Mr. MORRISON. OK.

Mr. BROADBENT. They turned down one in Nevada.

Mrs. LLOYD. Thank you very much, Mr. Broadbent.

Mr. MORRISON. Thank you, Madam Chairman.

Mrs. LLOYD. Thank you very much, Mr. Morrison.

Mr. Stallings.

Mr. STALLINGS. How much waste a year is generated by the nuclear facilities in this country?

Mr. BROADBENT. I wouldn't have any idea. I just heard somebody from Virginia Power say something about 2,000 tons a year. But that isn't a question I would be able to answer.

Mr. STALLINGS. Of the sites you have considered geologically, which looks the most feasable?

Mr. BROADBENT. I think it's important to recognize that there has not been a full environmental impact statement done on any of the sites yet. All we are trying to identify, as I understand it, what DOE is trying to do is to identify those three sites that have the best possibility of being the sites that you might pick. And I would hate, as I looked at the environmental assessments, and I read all of them, I think as you look at that site characterization, it looks like three to five of the sites are very, very close together.

Mr. STALLINGS. Are they large enough to take waste into the next century?

Mr. BROADBENT. As I understand it, they are, yes, or can be built to accept that waste. You know, there is a provision for a second site to be built in the East, but as I see it, they are, yes. That would be one of the criteria to pick it.

Mr. STALLINGS. That is all. No other questions.

Mrs. LLOYD. Thank you very much.

Mr. Monson.

Mr. MONSON. Thank you, Madam Chairman.

Your statement mentions the USGS involvement in the review of the geologic and geophysical study of the bedded salt site in southern Utah. Could you briefly indicate what the major conclusions of the USGS are regarding the geological suitability of this site as a permanent repository for high level wastes?

Mr. BROADBENT. I am not sure that the Geological Survey has yet commented on the environmental assessments and they didn't directly do the site characterization on that study, so I don't think I could tell you that yet, Mr. Monson.

I think when we comment on the draft environmental assessment, I would be able to do that, and we may have. If we do, I will be glad to provide it for the record.

I would like to say that the Department of the Interior does have an interest in the Utah site because of Canyon Lands National Park and has as such taken a position in opposition to that site as it affects the park.

Mr. MONSON. Are you aware of the proposal that my colleagues and I from Utah just announced that we would include in our parks wilderness bill that we will be introducing shortly an expansion of Canyon Lands to include the two sites that were under consideration?

Mr. **Broadbent**. No, I haven't.

Mr. **Monson**. Would you care to comment on that?

Mr. **Broadbent**. No. I wouldn't care to comment on it. I have found that hardly any of the States want any of the sites. The only one I haven't heard say anything has been the State of Washington.

Mr. **Morrison**. Don't ask.

Mr. **Monson**. Thank you.

Mrs. **Lloyd**. Thank you very much.

Mr. Fawell.

Mr. **Fawell**. I have no questions.

Mrs. **Lloyd**. Thank you very much, Mr. Broadbent, for giving us the benefit of your wisdom today.

Mr. **Broadbent**. Thank you.

Mrs. **Lloyd**. Our next witness is Sheldon Meyers, from the Environmental Protection Agency.

Sheldon's is a very familiar face because he frequently testified before the committee on the Department of Energy Nuclear Waste Program when he as at the Department during the Carter administration.

We are very happy to have you with us today, Shelly, and in your new capacity as Acting Director of the Office of Radiation Programs with the Environmental Protection Agency.

Your written statement is before us, and you may proceed as you wish.

STATEMENT OF SHELDON MEYERS, ACTING DIRECTOR, OFFICE OF RADIATION PROGRAMS, U.S. ENVIRONMENTAL PROTECTION AGENCY

Mr. **Meyers**. Madam Chairman, distinguished members of the subcommittee, I am pleased to be with you today to discuss EPA's role in the Civilian Nuclear Waste Management Program under the Nuclear Waste Policy Act of 1982 and about our continuing interaction with the Department of Energy concering this very important national program.

The Nuclear Waste Policy Act of 1982 assigns one specfic responsibility to EPA as part of the national program: Section 121 requires that EPA promulgate generally applicable standards for the protection of the general environment from offsite releases from radioactive material in repositories.

These standards were to be promulgated 1 year from the date of enactment of the statute, that is, on January 7, 1984. Unfortunately, EPA has not met this statutory deadline. There are several reasons why we missed this deadline which I will discuss later on. But for now, let me say that the standards are now in the final process of internal review within our office and I expect that they will be finally promulgated by Administrator Thomas in the next several months.

I should mention also that a coalition of environmental organizations has recently brought an action against EPA to compel the agency to pursue the high-level waste standards promptly.

EPA first proposed these standards on December 29, 1982, just a few days before the Nuclear Waste Policy Act of 1982 became law. Technically, they are called Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Wastes, 40 CFR 191.

The agency had been working on the standard for several years in the realization that they would be needed in a timely fashion as the national program took shape. Today I would like to review for you what these proposed standards cover and how we have approached the very significant problems involved.

I would also like to speak about our review process, which I think will give you some insights into how and why we missed the statutory deadline; and, finally, I would like to talk about our relationship with the Department of Energy and also with the Nuclear Regulatory Commission.

EPA's role in this process is a limited, but at the same time, a very important one. This Nuclear Regulatory Commission will have the responsibility for the implementation and site-specific application of the generally applicable standards we prescribe. EPA has no direct role in the selection of actual sites for high-level waste repositories.

The Nuclear Waste Policy Act assigns that responsibility to the Department of Energy, with oversight by NRC, and it must be done in consultation with affected States and Indian tribes. Our only involvement in site-specific activities would be to review the environmental assessments prepared by DOE or its contractors.

Now let me discuss what our standards cover: Our proposed standards apply to spent reactor fuel, the highly radioactive wastes derived from reprocessing spent fuel, and those transuranic wastes containing 100 or more nanocuries per gram and with half-lives of more than 20 years.

The proposed standards do not apply to wastes which have already been disposed of. This exception would affect only transuranic wastes since, of course, no high-level wastes have been disposed of in this country. Also, our standards do not apply to ocean disposal of high-level waste which is prohibited by the Marine Protection, Research and Sanctuaries Act of 1972.

Our environmental standards do apply to both the management and disposal of the wastes. We have divided the rule into two subparts: Subpart A applies to management, including storage, preparation of the wastes, and placing them in a disposal site. This part deals with both temporary storage facilities and monitored retrievable storage. Subpart B takes over once the repository has been sealed.

In 1977, EPA promulgated its Uranium Fuel Cycle Standards—40 CFR 190—which covered operations from uranium milling through reprocessing. Subpart A of our new rule is a continuation of this rule, and applies to waste management operations not covered in part 190, which is the fuel cycle standard.

These operations involve the storage of the materials, the solidification or other preparation for disposal, and the placing of wastes in disposal sites. Subpart A also applies to spent fuel management, regardless of whether the fuel is considered to be waste or is destined for reprocessing.

Our studies tell us that the largest expected radiation exposures to the public from activities covered by these standards would be no more than a few millirem per year. In other words, any exposures would be somewhat smaller than the requirements set out in part 190. We have, therefore, decided to extend the type of dose limits contained in part 190 to the operations addressed in subpart A.

In subpart B, we use a different approach because there we are devising environmental standards for the period after the repository is sealed. This involves very different considerations.

First, the requirements we establish in subpart B can only be implemented by the NRC and DOE in the design phase, by setting design principles or by analytically projecting disposal system performance. We obviously cannot rely on the familiar kinds of monitoring of emissions or measuring ambient levels of pollutants in this instance becasue of the long time periods involved. Our rule speaks of isolation for 10,000 years.

Second, the standards must address unintentional releases, such as those resulting from human intrusion or geologic faulting. Provisions must be applicable to a variety of disposal strategies because EPA does not have the authority to specify details or to direct DOE or NRC concerning any one of a number of disposal methods or designs. Requirements by NRC or DOE, as appropriate, will control the specific designs.

For long-term containment requirements, we assumed that it is possible to predict some aspect of the future well enough to use the predictions for comparing and selecting disposal methods. First, we evaluated ways that waste might be released from a mined geologic repository, and we developed analytical models to predict potential releases and their distribution throughout the ecosystem over a 10,000-year period. We then estimated the possible risks that could result from these releases if they occurred in an environment similar to today's.

In selecting the release limits for the standards, we had to project the performance of disposal systems which, of course, have not yet been demonstrated. Naturally, there are significant uncertainties inherent in such projections.

To avoid underestimating these risks we often made pessimistic assumptions about how well as repository would work. For example, we assumed that human intrusion into a repository beginning 100 years after disposal would take place just as though no site markers or records discouraged it.

Our estimates are, in fact, the upper bounds of the risks. When DOE selects and demonstrates actual control methods at a real repository site, we expect that releases will be well below the amounts allowed by the proposed standards.

There is another reason why subpart B differs so much from subpart A; The standards in subpart B must accommodate large uncertainties, uncertainties in our current knowledge about disposal techniques, and inherent uncertainties about the future.

We faced these issues by developing assurance requirements which try to address and compensate for the uncertainties that necessarily accompany plans to isolate these wastes from the environment for such a very long time. No matter how promising analytical projections of a given disposal system's performance appear, we believe that high-level and transuranic wastes should be disposed of in a cautious manner and in a way that reduces the likelihood of unanticipated releases.

The containment and assurance requirements we feel are complementary: the containment requirements set limits on potential releases of radiocative materials; the assurance requirements provide the framework necessary to develop the kind of confidence we need to meet the containment requirements, even in the face of uncertainties inherent in a process of such enormous duration.

As I mentioned at the start, EPA does not have enforcement authority in this radiation area. The standards for waste management operations will, therefore, be implemented by the Nuclear Regulatory Commission for its licensed activities, and by the Department of Energy for national defense facilities.

The standards for disposals, subpart B, will be implemented by the Nuclear Regulatory Commission for all high-level wastes, whether the wastes come from commercial or military activities. The Nuclear Regulatory Commission will do this by developing its own regulations and by deciding whether and when to issue the necessary licenses. Under current law, disposal of transuranic wastes from military activities is not regulated by NRC; therefore, the Deparment of Energy will carry out our requirements for disposal of this category of wastes.

Now, if I may, I would like to discuss what EPA has been doing in the last year and why we missed the deadline of January 7, 1984, contained in the act.

Because of the importance of these standards, EPA has gone out of its way to subject them to the highest kind of scientific scrutiny. The Administrator asked a special panel of its Science Advisory Board to review the proposed standards and their supporting documentation in January 1983. The special panel's final report was submitted to Administrator Ruckelshaus, 1 year later, in February 1984. During the intervening year, the staff of the Office of Radiation Programs spent a great deal of time assisting the SAB in its review.

When the SAB review was completed, the Office turned toward making the appropriate modifications to the standard itself and the supporting analysis where the review had indicated the need to do so. Several issues raised by the SAB were identical with those we received during the public comment period. A few of the issues raised by the SAB deserve special discussion today.

The SAB was supportive of the basic structure of EPA's proposed standards, including the focus on limits of total releases over a 10,000-year time period. But the panel suggested that more reasonable estimates should be used instead of overly conservative factors in that part of your analysis in which we relate releases of radioactivity to long-term population risks.

Our response was to revise this analysis using less conservative factors. This revision showed that the same level of protection could be achieved with a sevenfold average increase in the limits on radionuclide releases permitted under our rule, even if we retain the same societal objective of no more than 1,000 extra health effects over a 10,000-year period, or an average of 1 effect per decade.

Another of the SAB recommendations was that the societal objectives set forth in EPA's proposed standards be made less stringent. Specifically, the SAB stated: "The subcommittee recommends that the release limits specified in Table 2 of the proposed standards be increased by a factor of ten, thereby causing a related tenfold relaxation of the proposed societal objective (population risk of cancer)." This was not a unanimous decision by the SAB subcommittee; two of the members chose to formally dissent in favor of our proposed societal objective.

In reviewing this particular SAB recommendation, we concluded that the societal objective used in the standard is a risk management matter, and the SAB's view, while deserving of serious attention, should not be an overriding consideration in choosing the final level of the standards.

Indeed, the special panel in its final report said that one of the reasons for the recommendation was the members inability to separate scientific and technical evaluations from matters of policy. This may have been due to the fact that the SAB in this case entered the process after EPA had proposed the standard, when many important risk management decisions had already been made.

Incidentally, we learned a lesson from this experience. In the future, we intend to involve the Science Advisory Board at the earliest possible phase of our deliberations.

After we received the SAB final report in February 1984, we spent a good deal of time reviewing our documentation and verifying our numbers. We had to do substantial new analyses in many cases to accommodate the SAB recommendations or in some cases to substantiate our reasons for not accepting the SAB's views completely.

Our most demanding and challenging effort during the past year, that is, calendar year 1984, has been to work with the Department of Energy and the Nuclear Regulatory Commission to ensure that the modifications were made in response to public comments and technical reviews have given us a viable standard, one which the responsible agencies can implement.

Throughout this process, our working relationship with the Department of Energy has been extraordinarily good, It has been characterized by professionalism on both sides and a cooperative spirit which says basically: "Let's get the job done."

After we complete our discussions with DOE and NRC and resolve the remaining final issues, we will still have some work to bring our background information documents up to date, and then we complete EPA's internal senior Management Review and the final interagency review. I expect, with a good degree of confidence, that we will promulgate our final standard within the next few months.

Madam Chairman, that concludes my prepared remarks, and I will be pleased to try to answer any questions the subcommittee may have.

Mrs. LLOYD. Thank you very much, Shelly. We appreciate your testimony. I want to refer to something I have written to you about previously, that the EPA has proposed material release standards relative to the repository that had been characterized as you know as very stringent and perhaps overly conservative. Some have charged that EPA's release standards combined with conservative requirements imposed by the NRC will make it very difficult for the Department of Energy to find the technology that can be proven to meet the standards in the regulatory process. I would like your comments on this today.

Mr. MEYERS. As I said in the testimony, we have been working very closely with the Department of Energy, and in all the meetings I have had with them they never once raised the issue of not being able to meet that societal objective. Our calculations on our own account and working with the NRC show that they will be able to make those societal objectives with ease. I was rather surprised to hear the question raised because it had never come up before. But based upon the information that we have in our own calculational models, working with NRC and the fact it was just never brought up by the Department of Energy, we are trying to put out a standard that is both protective of public health and achievable.

Mrs. LLOYD. This is something I wanted to be included in the record and something we will pursue further with DOE.

Second, would you clarify your statement on why EPA rejected the advice of its Science Advisory Board to institute the tenfold reduction in the nuclide release limits?

Mr. MEYERS. Surely. Those particular numbers, the 1,000 health effects and 10,000 years, came about by both analysis of how repositories would perform and also by comparing them with the kind of releases one would achieve from natural uranium bodies. And when you look at numbers and the long period of time involved, we felt that we wanted to give the kind of confidence that I think the public demands and also that DOE can meet in terms of that societal objective of 1,000 health effects over 10,000 years. The SAB was not unanimous in their recommendation; more over—it was not a scientific subject. It is the kind of decision that the Administrator is responsible for making in our Agency, and thus far our office has felt that it would be far better to retain that 1,000 health effects in 10,000 years so that the public can have a higher degree of assurance that the Federal Government is doing what they can to protect them, wherever this repository is located.

Mrs. LLOYD. Mr. Morrison.

Mr. MORRISON. Thank you, Mr. Chairman.

Shelly, it is good to see you again, and under a different hat than before.

One of the questions I asked of the Nuclear Regulatory Commission was concern that there was a lack of public understanding, particularly in the areas closest to the first three selected repository sites, as to the involvement of the other Federal agencies. Has EPA been concerned about this as well, and do you have any programs for outreach to the public so that they know that you are watching and have a role in the DOE site characterization and selection processes?

Mr. MEYERS. First, we do not have a program for outreach. Remember our standard is a small part of this exercise, and the major way we get across that we are involved is by attending, when invited, various public meetings and professional societies which do not really get to the people you are talking about, Hanford, Nevada, and Texas. We are very pleased to attend those kind of public meetings and describe what EPA does, but we do not have a formal outreach program.

Are you familiar with this new committee that was set up under the Office of Science and Technology Policy, the Committee on Interagency Radiation Research and Policy Coordination?

Mr. MORRISON. Yes, I worked with them on food irradiation, not related though to this particular subject.

Mr. MEYERS. I bring it up because we have raised in that particular forum the possibility of having an organization like that, which does not have a particular axe to grind, they are not running a program in the arena, as to whether or not they would be interested in trying to get out more information to the public at large about what radiation is and what effect it has.

Mr. MORRISON. I mention this because even though as you described your role being a small part, I think the public perceives of you as a watchdog of their particular personal concerns. Maybe there is some way we can work with you in multiplying the public understanding of your role and the role of the NRC in this whole process.

Mr. MEYERS. We would be pleased to cooperate in that kind of effort.

Mr. MORRISON. Thank you very much. You listed some assurances, some assurance requirements in your testimony and one of them, No. 5, sites should not be located where scarce or easily accessible resources are located. Could you give some examples of what those scarce resources might well include? From my point of view, is water one of them?

Mr. MEYERS. We were not thinking of water, we were thinking of oil and perhaps mineral resources. I think it is a very obvious kind of assurance requirement; in that it would be not—I am not quite sure how to word it—but if you located a repository where there were clearly oil deposits, coal deposits, whatever mineral resources that were important, you would have a problem keeping that repository intact. So it was to avoid, when you site the repository, try to avoid locations where there are mineral resources. We were not thinking of water.

Mr. MORRISON. Your agency has some followup responsibilities, particularly in the enforcement of the regulations that you are preparing now. In a question I asked of the Nuclear Regulatory Commission about State involvement, where there could be duplication and overlap, do you see any difficulty with that as a followup to your responsibility at these various sites?

Mr. MEYERS. Again I mentioned earlier in the testimony that our regulation is enforceable by NRC. We will not have a separate enforcement operation under way. We will be working with NRC to make certain that they are indeed following through, but there will not be EPA inspectors going out to the sites as well. I think it is also important to have some sort of effort with the States so that they have some degree of assurance that what they see in writing is indeed being accomplished.

Whether that is done formally or informally I am not certain what the best way is, but clearly the States ought to have some role in seeing that the enforcement activities go on as planned.

Mr. MORRISON. You did not mention this, Shelly, but it relates to nuclear matter. Could you update the committee on the progress being made on reconciling the mixed-waste issue, where we have radioactive waste along with the toxic materials?

Mr. MEYERS. There was a meeting sponsored by one of the staffers up here, I think Congressman Udall's staff, with a number of people interested in the subject about 3 weeks ago. The thought was do we need legislation or not? I think the general agreement was that we seemed to be on a path of working out the problems that are associated with radioactive wastes and wastes that would be regulated under RCRA. I guess the charge was to continue those working relationships with DOE and the EPA staff that is responsible for RCRA. They all seemed to think there was light at the end of the tunnel and we would indeed have a solution so that legislation might not be needed to correct the problem. That was I think about 3 weeks ago.

Mr. MORRISON. Thank you very much.

Mrs. LLOYD. Thank you, Mr. Morrison.

Mr. Stallings.

Mr. STALLINGS. No questions.

Mrs. LLOYD. Mr. Monson.

Mr. MONSON. I have no questions.

Mrs. LLOYD. Mr. Fawell.

Mr. FAWELL. I have no questions.

Mrs. LLOYD. Thank you for being with us again today, Shelly, and for all of our witnesses. Your testimony has been excellent. As usual, we do think of some questions after the hearings are over. I hope all of you will respond to questions in writing for the record as well.

This subcommittee will meet again at 8:30 a.m. in the morning in this room to hear from our Department of Energy witnesses on the uranium enrichment program.

[Whereupon, at 3:10 p.m., the subcommittee was recessed, to reconvene at 8:30 a.m., Tuesday, March 5, 1985.]

APPENDIX I

SUPPLEMENTAL INFORMATION FOR THE RECORD

EPRI
Electric Power
Research Institute

March 15, 1985

The Honorable Marilyn Lloyd
Chairman, Subcommittee on Energy
Research and Production
Committee on Science and Technology
Room B-374, Rayburn House Office Building
Washington, DC 20515

Dear Chairman Lloyd:

As requested in Ms. Nancy Jeffery's note of March 7, 1985, I am returning the verbatim transcript of my testimony on LWR's and LMR's given before the Subcommittee on Energy Research and Production on February 21, 1985. As you will note from reviewing the transcript, there are a number of changes which I would like to have made a part of the record. It is my understanding that the changes I have written will be noted in footnotes and the text appended to the verbatim testimony. I have attached a typewritten copy of these changes, noting the page and line numbers for easy reference.

Thank you for appending these comments to the record.

Sincerely,

Robert L Loftness for
Floyd L. Culler
President

kea:km

Enclosures: As stated

cc: Nancy Jeffery, w/enclosures

1800 Massachusetts Ave., NW, Suite 700, Washington, DC 20036 Telephone (202) 872-9222
Headquarters: 3412 Hillview Avenue, Post Office Box 10412, Palo Alto, CA 94303 (415) 855-2000

Mr. CULLER. Madam Chairman, I will answer the question with the advantage of having recently completed a review of LWR R&D for the Energy Research Advisory Board, to be published soon.

Basically, we are pleased that the Department of Energy is expanding slightly its program in light-water reactor R&D, with programs of a little more scope than in previous years. The proposed program is oriented properly, but most certainly underfunded. The role that the Energy Research Advisory Board has suggested for the Department of Energy in LWR safety research in a report completed in 1983 reviewing overall light water reactor safety R&D worldwide, is to do more advanced or creative R&D, of which little is now being done. The principal role for DOE is appropriately directed to this work, plus R&D support for TMI-2 and particular support for the current programs on source term.

For light water reactors, support for the conceptual designs and approaches to advanced reactors is appropriate. The industry, through EPRI, in cooperation with reactor manufacturers and architect engineers, will look, hopefully with some help from DOE, at the

evolutionary improvements that could be ready for use in the 1990s. Working with such advanced concepts, such as Bert Wolfe has discussed, and those of Westinghouse,
1197 EPRI is now initiating this program.

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1198 The Department of Energy's program should be expanded to look at more advanced concepts as well as to support the rationalization of nuclear power, as Mr. Wolfe has suggested, i.e., to place increased attention on how to manufacture, how to standardize, how to improve the particular safety characteristics of existing light-water reactors. It is important, too, to look at the possibilities for reducing size in a very realistic way; size reduction which increases power costs is unlikely to be useful or used because there are quite competitive clean coal burning systems now under near full-scale demonstration.

Thus, price competition for nuclear is clearly evident from the fossil area. With the new systems--the coal gasification combined cycles and fluidized beds--we have future technology about to operate at large scale, technology that will greatly reduce acidic emissions and the utilities' contribution to acid rain. It should be possible to produce power from coal at levelized costs of 60 or so mills (1983 dollars) per kilowatt-hour, cleanly and with somewhat modular plants in sizes ranging from 200 to 400 Mw in capacity.

Advanced light-water reactors, as well as other advanced reactor types for the future, must meet this economic competition; otherwise, the electric utilities will not opt for nuclear power, regardless of size or safety features, whether or not there is less risk from regulatory pressure.

EPRI's role, and the interest of the utilities, is to assist in looking at advanced, basically evolutionary light water reactor designs, recognizing the need for economic competitiveness, both in capital and life cycle
1222 costs.

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1223 DOE's support in this is necessary, particularly as a supporter for the more advanced concepts. Their programs are not adequately funded under the proposed budget. The amount of money that is available for all of nuclear fission reactor support as proposed is too small to accomplish what is needed; for LMFBR, for gas cooled reactors and for basic nuclear fission support. As now funded, very difficult decisions will have to be made by the Department as to how money will be distributed.

1230 Ms. LLOYD. Would you like to recommend a figure for DOE, one that's adequate?

Mr. CULLER: In the light-water reactor program, I think the proposals in the $50-70 million range are much too low to cover participation in TMI-2 research, the source term and advanced LWR reactor concepts and experimentation. To cover the options will require about $150 million per year, including experimental work in advanced safety systems, building over several years, and starting with about $90 million in 1986. I think, as a result of this hearing and the review of your subcommittee, the level of support for advanced LWR's should be raised. 1239

Ms. LLOYD. We look forward to continuing to hear from you, and I would also like to hear your perspectives on the acid rain as well.

Mr. CULLER: Thank you.

Ms. LLOYD. As you know, I have a coal bill which I am interested in as well.

Mr. CULLER. Thank you. If you would like, I will answer additional questions by letter later. We hope that support from each sector can be used to improve costs, reliability and safety of LWR's -- support from the utilities, the reactor manufacturers, the architect engineers and DOE.

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Ms. LLOYD. Thank you very much.

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Mr. CULLER. Madam Chairman, I failed to emphasize adequately the need for support by DOE for certain areas of immediate importance--the support of TMI cleanup (the areas that Ed Kintner has discussed) and certain very significant experiments on the source term--involving the use of facilities that belong to the Department of Energy at LOFT and other experimental areas. Support for these very important near-term experiments is vital.

There is altogether $150 million of work in progress on the source term over the period of the next 18 months (and maybe more) with cooperative support from NRC, DOE, the private sector and on an international basis. The participation of DOE in these efforts to obtain the knowledge that is available from TMI, and experimentally for the source term, is absolutely essential. These efforts should have priority over the long-term advanced studies because of its immediate importance to the overall
1297 future of nuclear power.

PAGE 66 and 67

1471 Mr. CULLER. An additional comment. As part of the EPRI industry program, there are industry support contracts to begin studying the PIUS concept. Our evaluation will study both economics and stability under transients in cooperation with ASEA-ATOM, Oak Ridge and the Nuclear Regulatory Commission. We will make it a part of the evaluation to see whether, under U.S. conditions, the economy and safety as just reported can be realized. Results should come out over a period of time and somewhat at the same pace as is being pursued for the small reactor
1482 concepts and other advanced systems.

1501 Mr. CULLER. Congressman Lujan, I think that the thrust of the testimony so far today, and much of the testimony that will be on file, clearly covers these subjects. Much can and should be done to assist in problems which remain for those reactors that are coming on or being constructed now, but much of this is of a regulatory nature. But the important thrust of the testimony today has concentrated on what we do after that to provide an advanced LWR that can be ordered in the 1990's. There are three principal lines. One is the evolutionary improvement already well along by GE, Westinghouse, Combustion Engineering and others.

The second advanced LWR reactor approach is to produce reactor designs, easier to build, safer, more reliable, hopefully smaller and less costly, with longer life. For these, no prototype would be necessary.

There is effort on a truly new concept, more in the realm for DOE funding, where ideas such as PIUS, other smaller reactors, more reliable, perhaps with greater novel safety features, are studied as design concepts. Some, if not all, of these, in my opinion, would require the construction of full-scale prototypes for demonstration. 1518

1524 Mr. CULLER. Over time these programs will converge; the effort will be more cohesive than we are presenting today, because there is a large coordination among participants, coordinated in part with DOE, and by the industry as well.

Today's testimony will provide the record with good ideas for directions to take. 1532

1543 Mr. CULLER. The testimony so far, to which I referred, was exclusively on light-water reactors. The utility industry is looking seriously at light-water reactors as the only reactor type that could be deployed in the 1990's. Within the EPRI organization we have approval to proceed with an advanced LWR program in three parts: first, to help those reactors now built or under construction; second, to evolve a better design, based on what we have learned over the past 20 years; third, to explore new concepts, over a period of five years or so, to evolve standard reactor designs, hopefully less costly in dollars per kilowatt and per kilowatt hour, much more reliable, with much higher onstream efficiency, and which can be built in shorter periods of time. 1555

3727 Mr. CULLER. Mr. Chairman, first of all, I would like to introduce you to Dr. Clark Gibbs, who is in charge of the Joint Department of Energy-EPRI Consolidated Management Office (CoMO) for breeders, located in Naperville, Chicago. Dr. Clark Gibbs.

Secondly, I would like to make a matter of record the written testimony which I have submitted.

In parallel and coordinated programs, the Electric Power Research Institute and the Department of Energy have taken the long term view for the overall breeder effort. As I listened today to the LMFR discussions, there were several things that are important in setting the overall context for what you have been hearing.

First, each of those who have testified on the breeder have discussed important but particular ideas for breeder reactors, with high enthusiasm for the new ideas in breeders. But there has been no discussion of an overall program. Other nations are operating what are technically successful liquid metal reactors. It is evident that for a rather long time in the future, the United States may not build a demonstration reactor of the breeder type, as others are doing. Our principal focus must be to learn how liquid metal reactors work and operate by setting up strong international agreements that allow us to participate in hands-on work. These activities should concentrate on Japan, on France on Germany and Great Britain. The liquid metal program is of significant importance to Japan, as it is to France. They are most likely to be the ones who build the next and most successful reactors.

Some time ago the Department of Energy asked the Electric Power Research Institute to develop, for their consideration and with their cooperation, a long-term, overall pattern in which nuclear breeder programs, particularly liquid metal reactors, might be considered for the future. I wish to discuss this contextual whole and comment briefly on what international programs are in progress, and to suggest where our opportunities may lie.

The massive cuts in the breeder program support, as you saw today, will cause what amounts to the dismantling of an effective liquid metal fast reactor program in the United States. Each man testified to the negative effects of budget cuts in his particular area. It grieves me, after 30 years of attention to breeders, to watch each of us plead again for the individual small pieces of a program, when the whole is being dismantled effectively, so that individual programs and ideas may not survive.

3767 The actions to reduce the breeder program are not necessarily generated within the Department of Energy. They are part of a budget-cutting exercise, which has drastically reduced support for energy development, particularly the breeder.

The long-term program must consider not only those new reactor concepts for which there was such enthusiasm shown today, but those also that are well-developed, running successfully overseas and here in experimental form. In order to participate overseas and to take advantage of 35 years of work on liquid metal reactors, here and abroad, a continuation of effort, which parallels European effort, originally and still based on U.S.
3773 developments, is necessary.

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3774 Recognize that the liquid metal reactor is perhaps as inherently safe as any concept yet proposed. It is possible to design them with a passive, natural convection system.

We have time to carry out a comprehensive, carefully coordinated program. Three phases are proposed: first, to explore how to cut costs and improve the inherent safety of liquid metal reactors, taking what we already know from the large reactors while reviewing and evaluating new reactor concepts about which you heard today.

Delete lines 3783 through 3787.

3788 As a consequence, the overall program proposed would include the evaluation of how to cut costs of large liquid metal reactors in the size range of 1000 Mw or larger as all others are pursuing. The Department of Energy has spent, in the last three or four years, some $70-80 million in the large loop design, studies which have been evaluated at CoMO. Proposals to reduce capital costs and to improve its safety characteristics have been evolved and will be reviewed by the NRC.

3795 We are now evaluating a second large reactor type. The pool-type liquid metal reactor design, based on concepts that were developed in the United States, and hopefully with input from Japan and the European breeder consortia, is being studied to reduce cost, improve

3798 characteristic safety and to improve constructibility.

NOTE: Substitute the following words for those in the verbal testimony, beginning at line 3799, page 174, and extending through line 3913, page 178.

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3799 The second phase of the proposed long-term program basically will be one of consolidation which would occur sometime in the 1990's. During this process, a selection of reactor (or reactors) will be made on which the U.S. community can concentrate further development, reactors chosen from the five or six concepts now under study and the large concepts being reevaluated. It is possible that by then, hopefully in conjunction with other countries, a liquid metal reactor might be built in which there would be true international cooperation. This reactor system, operating in experimental mode, would be the basis for a standardized, prelicensed breeder system which could be built when needed as a regenerative fuel source, or an economical power producer competitive with coal or light water reactors. In the United States, our guess is that such a breeder would not emerge as an available option and a proven design much before 2010.

The several elements of this long range approach are in place, or are about to be put in place, by the Department of Energy, the utilities--through EPRI--and the reactor suppliers and architect engineers. All have been active in breeder development since the early 1950's.

The first study element of the long-range plan is design and concept changes to cut costs and to improve breeder concepts. Detailed designs and/or operating experience are available from the large US breeder programs of previous years. Loop designs of 1000 Mw size have been reviewed, and changes to improve safety and cut costs are being studied by the Nuclear Regulatory Commission. Pool-type large reactor design review is now in progress.

The second study element of the long range plan has been started by the Department of Energy. Contracts for studies of advanced and novel breeder concepts have been established with several reactor manufacturer teams and one national laboratory. These new concepts were discussed today. Most propose systems that are smaller than 1000 Mw capacity to reduce the total capital cost, and thus the financial risk, for liquid metal reactors. Smaller reactors must, of course, produce electricity at costs that are competitive with coal fired plants, a test that even large liquid metal reactors have yet to be able to do, in spite of their significant advantage of scale.

The third element of the long range plan is the base experimental program. It has been the basis of the U.S. and foreign programs for thirty years. It is necessary for future liquid metal reactor development to produce safe and reliable operating equipment and controls. Here the U.S. has the advantage of excellent experimental facilities--the FFTF, the EBRII, the LMEC, the Fuel Fabrication Center at Hanford, the chemical recycle program at Oak Ridge, the metal fueled reactor systems at Argonne and Idaho, and others. It has a large group of scientists and engineers with many years of experience in liquid metal reactor development. For the U.S. to remain effective in breeder development, this experimental effort must be focused and maintained.

The final element of a long range program must be an active and meaningful exchange program with other countries who are developing and particularly who are building and operating breeders. International cooperative agreements make it possible for the U.S. to get access to design and construction experience, and operating data. If we do not build, we will need to be dependent upon those who do for practical knowledge and proof. For this exchange to be successful, we must have valid and valuable information to exchange. Thus, the compelling reason for international cooperation is for us to be able to share in efforts that lead to construction and demonstration, not to obtain funds to defray costs of our domestic efforts.

Our U.S. efforts and program results must provide a "quid pro quo" for our participation with other countries. With a strong and organized effort, this is readily possible, but we must be ready for open and inclusive exchange.

I have a suggestion for a trading chip in which I think we have an advantage. Our program and facilities at Hanford for Pu breeder fuel fabrication is as advanced as any in the world. The facility at Hanford includes cells for chemical recycle capability of breeder fuel and blankets which is far advanced as a result of work at Oak Ridge National Laboratory. If a small breeder chemical fuel recycle is added to the Hanford fuel fabrication plant, as is proposed in the BRET project, the U.S. would possess the most advanced total recycle facility in the world.

DOE and the private sector have cooperated in seeking cooperative programs with other breeder countries. A limited formal exchange agreement exists between the utilities in Japan and EPRI's CoMO; both governments are cognizant and supportive of this agreement. Limited information exchange agreements exist between CEA and DOE, UKAEA and DOE and others. But, these must be expanded to include data to be gained from detailed design and design reviews, experience in construction, costs and operating results.

In considering the approximately 20 years that the future U.S. breeder program may continue, it is necessary to define roles. The development of an economical breeder is still a long range project for which the principal costs must be borne by the government of the United States, just as the costs of breeder development and demonstration will be directly or indirectly borne by the governments of other countries. The utilities of the United States cannot fund a program of such long duration or cost. Nor can the reactor suppliers or architect engineers. Long range, major development is still the responsibility of the federal government.

It is important for us to realize that work on breeders continues in many countries because fission breeding is still the only technically demonstrated essentially renewable energy resource. France continues with an outstanding breeder effort, joined by other European nations in cooperative effort. Germany, the United Kingdom, Japan and India press for economical breeding. Russia is operating experimental breeders and is studying breeder designs of 1600 Mw and larger. I hope that it will be possible for the United States to maintain a viable breeder program of quality and depth sufficient to allow us to participate as a partner in such developments.

And I am not sure that the proposed funding, with the clear possibility of future cuts, will make it possible to maintain a viable U.S. breeder effort. We are witnessing the dismantling of the 30 year old U.S. breeder effort. This year's budget cuts, taken on top of last year's and the loss of a demonstration program, will make it necessary to close facilities, fire experienced people, and drop activity on breeders to a below-critical level. The cuts are not DOE's action alone. They are partially a result of Congressional direction, direction which I hope can be changed. This committee and several Senate committees are the last remaining places where a comprehensive national breeder program can be maintained.

If breeder funding is reduced further, our domestic program will unravel even more with each participating scrambling for his share of the diminished resources available. And we will lose the necessary base for our fragile international agreements.

3912 Thank you very much.

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3919 Mr. CULLER. Yes, we discuss them regularly. Our activities are very closely coordinated. EPRI has a continuing Memorandum of Understanding with the DOE, which has been in effect for 10 years. Since EPRI's broad interest corresponds with the broad interest of DOE, we plan together and hopefully evolve complementary efforts of value to both.

I wish to repeat a comment which I touched on briefly earlier. It is not likely that the electric utilities will be able to participate significantly financially in these advanced programs beyond the several million dollars a year that EPRI will be able to invest. This will be the case for some period of time.

Mr. STALLINGS. Have you had much interest on the part of these other countries you've been dealing with, particularly Japan, on going along with the funding of some of these programs? Are they interested in that?

Mr. CULLER. To count on significant funding from any foreign country would be a false hope. What they are looking for is participation in kind. They may fund relatively small equipment or tests that can best be done in our facilities. But they would not undertake the expense of sustaining the FFTF, or any major element of our continuing program.

Similarly, they may expect us to invest in some of their facilities. We do that to some extent now. EPRI has an earthquake program which includes work in Japan and Taiwan. We have formal agreements in which they are assigning personnel to CoMO. Various contractors--GE, Westinghouse and others--also work cooperatively in this EPRI-DOE office.

Mr. STALLINGS. But they will want to share in a lot of the--

Mr. CULLER. They will share by doing work that compliments ours, but I doubt that there will be much money that is cross invested. Perhaps in the long run it's possible. Old hands who discuss international programs suggest the possibility of building a series of reactors in which all benefit from results. Perhaps the first reactor might be built in Japan in which we would participate in kind; then the second may be in Britain or France, and the third perhaps, by then, in the U.S. This sequence would provide a mechanism by which all can learn in cooperative pooling of information from essentially individually funded demonstration units.

This idea is falling apart a bit primarily because of the uncertainty in the U.S. program. But then it was never a reality. Nonetheless, the interest still remains, and we will continue to pursue the possibility in frequent conversations.

Mr. STALLINGS. Do we share the results of these tests with them on an equal basis?

Mr. CULLER. We have restrictions and so do they. Almost all basic science that the Department of Energy and

EPRI has produced in nuclear power is made available. But, there are restrictions of flow in both directions on designs and fuel reprocessing performance. Both Britain and France, and Japan to a limited extent, consider that there may be a commercial payoff to these programs. In my opinion, this may not be so. There will not be an international competitive market for 30 years. It is not likely that France will sell the U.S. a reactor, and probably not to Japan. Japan will build Japan's reactor and Britain will build Britain's reactor. I think, too, that the U.S. will build the U.S. breeder reactors.

As you consider the breeder program, I hope you all will consider a time horizon that goes beyond 2010. We have discussed early phases today, i.e., the evaluation and review period. The program cannot be centered on small reactors or novel new concepts alone. It must include, as a necessary part for international cooperation, the evaluation of costs and additional safety features of large systems as well. I think that reactors larger than 500 Mw are the only ones that will meet the economic competition test from coal and light water reactors.

Mr. CULLER. Thank you, Mr. Chairman. I would like to submit my prepared statement, which follows, as part of the record of these hearings.

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GAS-COOLED REACTOR ASSOCIATES
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Chairman

February 12, 1985

The Honorable Don Fuqua
Chairman, House Science and
Technology Committee
2334 Rayburn House Office Bldg.
Washington, D.C. 20515

The Honorable Marilyn Lloyd
Chairwoman, Energy Research and
Production Subcommittee, House
Science and Technology Committee
2334 Rayburn House Office Bldg.
Washington, D.C. 20515

Dear Mr. Chairman and Madam Chairwoman:

On behalf of the major private sector participants in the HTGR Program, we respectfully submit a joint statement for the Congressional Record in support of the DOE's HTGR Program and budget for FY 1986. We look forward to the upcoming hearings on February 21 and the occasion to expand upon the bases for our support of the HTGR.

Sincerely,

R. F. Walker

R. F. Walker, President
Public Service Co. of Colorado
Chairman, Gas-Cooled Reactor Assoc.

RFW:LDM:mb

cc: The Honorable John S. Herrington,
Secretary, Department of Energy

Members of House Science and Technology Committee

JOINT STATEMENT ON THE DOE HTGR PROGRAM

TO SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION

COMMITTEE ON SCIENCE AND TECHNOLOGY

UNITED STATES HOUSE OF REPRESENTATIVES

Nuclear energy has become a vital element of the U.S. energy economy and offers the potential for a limitless energy resource for the future. However, in order for the U.S. to fully capitalize on the nuclear potential, advanced designs and concepts should be developed to complement the current generation of nuclear power systems. Further, the U.S. should provide leadership in the development of advanced nuclear systems in order to guide the deployment of nuclear power by developing countries as well as to gain a share of this international market.

Among the options for advanced nuclear systems, the High Temperature Gas-Cooled Reactor (HTGR) is emerging as a candidate of high national interest. The bases for this interest are the unique high temperature capabilities for highly efficient generation, cogeneration and process heat applications that provide an important complement to the overall nuclear option's future contribution to national energy security. The high temperature capabilities result from the inherent material characteristics (ceramic fuel, graphite core and helium coolant) that also permit the HTGR to: 1) meet safety and licensing requirements with a minimal reliance on engineered safety systems; 2) provide substantial time (measured in hours) for operator response to postulated reactor upset conditions; 3) provide added margins for plant investment protection; 4) provide added siting flexibility; and 5) assure low radiation exposure of plant personnel.

During the past fifteen months, a comprehensive evaluation effort has been underway by participants in the DOE HTGR Program. Through this effort, a consensus has evolved among the private-sector participants on the future direction and several key elements of the HTGR Program. These are summarized below:

1. The preferred concept for initial deployment in the U.S. is the steel vessel modular design. This selection which was based on evaluation criteria established within the HTGR Program is fully responsive to the Program objectives defined by the DOE and the House Science and Technology Committee. For the balance of FY 1985 and the next few years, available resources should be focused on pursuing this single concept.

2. The most effective approach for advancing the modular HTGR to a point where it would be available for commercial deployment is through the conduct of a full scale Licensing and Technology Test Project. Key objectives of a Licensing and Technology Test Project would be to implement the "license by test concept" and to demonstrate performance, cost and schedule features of the modular HTGR.

3. International cooperation on the HTGR should be expanded to optimize the cost and technical benefits to the U.S. Program.

With regard to the FY 1986 budget, it is recommended that the overall DOE HTGR Program be funded at a minimum level of $38 million, including the spent fuel management program. The emphasis of the Program should be on advancing the design of the modular HTGR and the preparation of a Preliminary Safety Information Document to be used as a basis for NRC review and issuance of a licensability statement. Also, a Licensing and Technology Test Project Plan should be prepared by the Program participants to support the FY 1987 budget request. The proposed budget level would support expeditious and efficient implementation of such a Project plus provide strong evidence of the Congressional support for revitalizing nuclear power in the U.S.

This joint statement has been respectfully submitted for the Record as evidence of the unified recommendations from the current industrial and utility participants in the DOE HTGR Program. Supplementary statements are expected to be submitted by some of the participants to expand on these recommendations.

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Howard W. Wahl
Vice President and Director
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TESTIMONY BEFORE THE

SUBCOMMITTEE ON ENERGY RESEARCH & PRODUCTION

HOUSE COMMITTEE ON SCIENCE & TECHNOLOGY

BY

WILLIAM J. DIRCKS

EXECUTIVE DIRECTOR FOR OPERATIONS

ON BEHALF OF THE

U.S. NUCLEAR REGULATORY COMMISSION

MARCH 4, 1985

MADAM CHAIRMAN, MEMBERS OF THE COMMITTEE:

AS REQUESTED IN YOUR LETTER OF INVITATION, I AM PLEASED TO DISCUSS THREE SUBJECTS RELATING TO NWPA ACTIVITIES: (1) INTERACTIONS BETWEEN NRC AND DOE; (2) NRC'S REQUIREMENTS OF DOE RELATIVE TO THE REPOSITORY PROGRAM; AND (3) A BRIEF SUMMARY OF PROPOSED ACTIVITIES FOR FY 86 AND FY 87 REGARDING THE REPOSITORY PROGRAM.

AS YOUR COMMITTEE IS AWARE, THE NUCLEAR REGULATORY COMMISSION'S PRINCIPLE RESPONSIBILITY IN THE HIGH-LEVEL WASTE PROGRAM IS TO LICENSE HIGH-LEVEL WASTE REPOSITORIES, PROVIDING THAT AN INDEPENDENT NRC DETERMINATION SHOWS THAT DOE'S PERFORMANCE OF ITS RESPONSIBILITIES MEETS REGULATORY REQUIREMENTS AND IS ADEQUATE TO PROTECT THE PUBLIC HEALTH AND SAFETY AND THE ENVIRONMENT. (TO DIFFERENTIATE BETWEEN NRC'S RESPONSIBILITY AND THAT OF THE ENVIRONMENTAL PROTECTION AGENCY (EPA), EPA HAS THE RESPONSIBILITY TO ESTABLISH GENERALLY APPLICABLE STANDARDS FOR THE PROTECTION OF THE GENERAL ENVIRONMENT FROM RADIOACTIVE MATERIAL; NRC HAS THE RESPONSIBILITY TO ASSURE THAT THE LIMITS ESTABLISHED BY THE EPA STANDARDS ARE NOT EXCEEDED.) EARLY, ON-GOING INTERACTION AND PRELICENSING CONSULTATION IS NECESSARY BETWEEN THE NRC AND DOE IF THE REPOSITORY PROGRAM IS TO BE ACCOMPLISHED WITHOUT COSTLY DELAY OR REWORK.

FOR A REPOSITORY TO BE LICENSED, THE NRC MUST FIND IN A FORMAL LICENSING PROCEEDING THAT THE REPOSITORY WILL MEET REGULATORY REQUIREMENTS AND THAT THERE IS REASONABLE ASSURANCE THAT THE PUBLIC HEALTH AND SAFETY AND THE ENVIRONMENT ARE ADEQUATELY

PROTECTED. TO PROVIDE FOR A THOROUGH, EFFECTIVE AND EFFICIENT LICENSING PROCESS FOR THIS FIRST-OF-A-KIND UNDERTAKING, THE NRC, IN A TIMELY MANNER, MUST DEVELOP THE METHODS FOR ASSESSING COMPLIANCE WITH PERFORMANCE OBJECTIVES TO PERMIT INDEPENDENT DETERMINATION OF THE ADEQUACY OF THE DOE PROGRAM; PROVIDE EARLY GUIDANCE TO DOE SO THAT DOE CAN PRODUCE ESSENTIAL AND ACCEPTABLE DATA WITHOUT COSTLY DELAY OR REWORK; PROVIDE ON-SITE OVERVIEW OF ACTIVITIES; IDENTIFY AND RESOLVE ISSUES; AND PROVIDE APPROPRIATE AND TIMELY REVIEW AND EVALUATION OF DOE'S SUBMITTALS.

OUR FIRST PRIORITY IS HEALTH AND SAFETY, AND WE REALIZE THIS FIRST-OF-A-KIND UNDERTAKING REQUIRES CLOSE COORDINATION BETWEEN DOE AND NRC IF IT IS TO BE SUCCESSFULLY AND SAFELY ACCOMPLISHED. ASSUMING THE AVAILABILITY OF RESOURCES AND THE ABSENCE OF MAJOR SAFETY ISSUES, THE NRC PROGRAM IS FASHIONED SO AS NOT TO DELAY THE DOE PROGRAM. WE DO HAVE CONCERNS THAT OUR FY 86 RESOURCES PROVIDED IN THE PRESIDENT'S BUDGET MAY RESULT IN SOME DELAY. WE WILL MAKE EVERY EFFORT TO MINIMIZE ANY DELAY.

INTERACTIONS BETWEEN DOE AND NRC

TURNING NOW TO THE INTERACTIONS BETWEEN DOE AND NRC UNDER NWPA, THERE ARE THREE PRINCIPAL AREAS IN WHICH WE INTERACT UNDER NWPA: HIGH-LEVEL WASTE REPOSITORY, FUEL STORAGE, AND TRANSPORTATION ACTIVITIES. IN EACH OF THESE AREAS WE HAVE ESTABLISHED, WHAT I CONSIDER TO BE, A PROPER FRAMEWORK FOR COMMUNICATION AND COORDINATION BETWEEN DOE -- THE AGENCY CHARGED WITH OPERATION -- AND NRC -- THE AGENCY CHARGED WITH SAFETY REGULATION.

In 1983, NRC and DOE concluded an agreement covering interaction on DOE's program for repository site investigation and characterization. Our objective has been to identify technical issues early and resolve them where possible in the period before DOE formally submits its license application. The master agreement is supplemented by agreements focused on implementing exchanges on specific repository projects in various geologic media. In order to assist this interaction, NRC has established on-site licensing representation for the three categories of geologic media involved in DOE's first repository project (basalt, tuff, and salt). In addition to management coordination on the course and timing of respective programmatic activities, we have held numerous workshops, data reviews and other types of technical meetings in our effort to identify, understand and resolve repository issues. Attachment A lists these scheduled staff coordination meetings.

NRC and DOE also concluded an agreement in 1983 concerning transportation packaging for spent fuel and high-level waste under provisions of the NWPA. It establishes common planning assumptions, and it outlines procedures which NRC and DOE will observe in connection with development of transportation packaging. The transportation involved would be physical movement to a geologic repository, a test and evaluation facility, a monitored retrievable storage facility, or an interim storage facility. Activity under this agreement is focused mainly on development of a new generation of shipping casks for spent fuel.

WE ARE CONTINUING OUR CLOSE COORDINATION WITH DOE ON ITS DEVELOPMENT AND DEMONSTRATION PROGRAMS FOR INTERIM DRY SPENT FUEL STORAGE TECHNOLOGIES, WHICH WILL PROVIDE TECHNICAL INFORMATION NEEDED IN THE LICENSING PROCESS. SECTION 218(A) OF THE NWPA REQUIRES DOE TO DEVELOP A DRY STORAGE DEMONSTRATION PROGRAM IN COOPERATION WITH THE INDUSTRY. ITS OBJECTIVE IS TO ESTABLISH TECHNOLOGIES THAT NRC MAY, BY RULE, APPROVE FOR INDUSTRY USE WITHOUT THE NEED -- TO THE MAXIMUM EXTENT PRACTICABLE -- FOR ADDITIONAL NRC SITE-SPECIFIC APPROVALS. SO FAR, WE HAVE RECEIVED INITIAL LICENSE APPLICATIONS FROM TWO UTILITIES FOR AT-REACTOR DRY STORAGE, BOTH OF WHICH HAVE COOPERATIVE AGREEMENTS FOR SUPPORT BY DOE. WE ALSO ARE REVIEWING SEVERAL TOPICAL REPORTS ON DRY-STORAGE-MODULE DESIGNS SUBMITTED BY POTENTIAL VENDORS. WE EXPECT TO COMPLETE A NUMBER OF THESE REVIEWS IN 1985-1986. THIS, COMBINED WITH INFORMATION GAINED FROM DOE PROGRAMS, WILL PROVIDE US WITH THE EXPERIENCE TO DEVELOP AND PUBLISH A RULE AS CONTEMPLATED IN THE NWPA. THE AVAILABILITY OF SUCH AN APPROVAL PROCESS FOR DRY STORAGE CASKS, UNDER RULEMAKING COMPLETED IN THE 1987-1988 TIMEFRAME, WILL SERVE TO ASSIST UTILITIES AS THE MAJOR NEEDS FOR ADDITIONAL SPENT FUEL STORAGE CAPACITY DEVELOP IN THE 1990'S. THROUGH RE-RACKING MODIFICATIONS OF EXISTING REACTOR STORAGE BASINS, MOST REACTORS HAVE STORAGE CAPACITY INTO THE 1990'S. A FEW SITES REQUIRING ADDITIONAL STORAGE CAPACITY IN THE LATE 1980'S HAVE PLANS FOR ROD CONSOLIDATION OPERATIONS IN THE EXISTING POOLS, USE OF DRY STORAGE MODULES, OR LIMITED TRANSSHIPMENT TO ALLEVIATE STORAGE SHORTFALLS.

THE STAFF HAS ESTABLISHED A CLOSE INTERACTION WITH DOE STAFF RESPONSIBLE FOR DEVELOPMENT OF THE MONITORED RETRIEVABLE STORAGE (MRS) PROPOSAL TO PROVIDE REGULATORY GUIDANCE TO DOE AND TO ENABLE US TO MAINTAIN FAMILIARITY WITH THE STORAGE DESIGN CONCEPTS BEING PURSUED BY DOE TO FACILITATE OUR REVIEW AND COMMENT ON THE PROPOSAL. WE ARE FAMILIAR WITH THE CONSIDERATIONS BEING GIVEN BY DOE FOR USE OF AN MRS AS PART OF AN INTEGRATED WASTE MANAGEMENT SYSTEM AS WELL AS ITS ROLE AS A BACKUP FOR THE REPOSITORY IN EVENT OF SUBSTANTIVE DELAY.

WITH RESPECT TO LICENSING OF AN MRS, SHOULD IT BE AUTHORIZED BY CONGRESS, WE HAVE ADVISED DOE THAT WE CONSIDER THE TECHNICAL CRITERIA OF OUR REGULATION FOR THE LICENSING OF SPENT FUEL STORAGE, 10 CFR PART 72, TO BE APPLICABLE TO AN MRS. THE STAFF IS PREPARING A PROPOSED REVISION TO PART 72 TO COVER MRS EXPLICITLY. STAFF EXPECTS TO SEEK PUBLIC COMMENT THIS YEAR. UPON COMPLETION, SUCH RULEMAKING WILL PROVIDE THE LICENSING BASIS FOR AN MRS IF CONGRESS SHOULD AUTHORIZE DOE TO PROCEED.

IN CONCLUDING MY REMARKS ON NRC/DOE INTERACTION, I WOULD LIKE TO NOTE THAT THE TWO AGENCIES HAVE CONSULTED ON THE POSSIBILITY OF FUNDING NRC'S HIGH-LEVEL WASTE PROGRAM FROM THE NUCLEAR WASTE FUND ESTABLISHED IN SECTION 302 OF THE NWPA. THERE HAS BEEN INTEREST IN SUCH POSSIBILITY, INCLUDING INTEREST ON THE PART OF OMB. OUR EXAMINATION OF THE CONGRESSIONAL RECORD, INCLUDING THE BASIS FOR THE INITIAL MILL-PER-KILOWATT-HOUR FEE, DOES NOT LEAD US TO A CLEARLY ESTABLISHED CONCLUSION THAT SUCH FUNDING WOULD BE WITHIN

THE CONGRESS'S INTENT. IN DISCUSSIONS WITH DOE, IT HAS BEEN RECOGNIZED THAT INCLUSION OF "LICENSING" AS A PERMITTED EXPENDITURE -- IN CONNECTION WITH THE SECRETARY'S AUTHORITY UNDER SECTION 302 TO PAY FOR CERTAIN COSTS -- MAY PROVIDE A BASIS FOR SOME DEGREE OF FUNDING BEING TRANSFERRED FROM DOE TO NRC FOR OUR NWPA REQUIREMENTS. WE ARE LOOKING INTO THE POSSIBILITY OF SUCH TRANSFER AND VARIOUS MECHANISMS WHICH MIGHT BE SUITABLE TO ACCOMPLISH THIS. A FINAL POSITION HAS NOT YET BEEN REACHED. NRC'S CHIEF CONCERN IS THAT DOE, AS AN NRC LICENSEE, MUST NOT BE -- AND MUST NOT BE PERCEIVED TO BE -- IN A POSITION TO RESTRICT OR INFLUENCE THE COMMISSION'S JUDGMENT IN CARRYING OUT NRC'S SAFETY AND ENVIRONMENTAL RESPONSIBILITIES UNDER THE NWPA.

NRC REQUIREMENTS OF DOE RELATIVE TO THE REPOSITORY PROGRAM

I NOW WILL DISCUSS BRIEFLY THE NRC REQUIREMENTS OF DOE RELATIVE TO THE REPOSITORY PROGRAM. THESE REQUIREMENTS, PRINCIPALLY WITHIN 10 CFR PART 60, CONSIST OF FOUR STEPS: AN EARLY INTERACTION WITH DOE DURING SITE CHARACTERIZATION PRIOR TO RECEIPT OF A LICENSE APPLICATION, A FORMAL HEARING ON THE DOE APPLICATION PRIOR TO CONSTRUCTION AUTHORIZATION, A SECOND LICENSING REVIEW AND HEARING PRIOR TO RECEIPT AND EMPLACEMENT OF THE HLW, AND A FINAL REVIEW WITH HEARING PRIOR TO SITE CLOSURE. PART 60 -- WHICH CONSISTS OF PROCEDURAL RULES AND TECHNICAL RULES -- SERVES AS THE BASIC NRC REQUIREMENTS. PART 60, WHICH PREDATES THE NWPA, CURRENTLY IS UNDERGOING CONSIDERATION FOR REVISION TO, AMONG OTHER THINGS, ASSURE CONSISTENCY WITH THE NWPA. ATTACHMENT B IS A COPY OF THE CURRENT PART 60; ATTACHMENT C IS A LISTING OF RULE MODIFICATIONS CURRENTLY UNDER CONSIDERATION.

THE PROVISION FOR EARLY REVIEW OF DOE'S SITE CHARACTERIZATION PLANS PROVIDES AN OPPORTUNITY FOR NRC TO POINT OUT THOSE ASPECTS OF A SITE WHICH, IN THE JUDGMENT OF NRC STAFF, REQUIRE SPECIAL ATTENTION OR MAY PRESENT SPECIAL PROBLEMS AS WELL AS AN OPPORTUNITY TO INDICATE PARTICULAR ITEMS OR INFORMATION NEEDED FOR THE COMMISSION TO MAKE LICENSING DECISIONS WITH RESPECT TO THE SITES BEING CONSIDERED. IN ADDITION TO THE RULES WHICH ESTABLISH THE BASIC REQUIREMENTS, THE NRC PROVIDES REGULATORY GUIDANCE TO THE DOE HLW REPOSITORY PROGRAM THROUGH VARIOUS MECHANISMS. THIS GUIDANCE IS INTENDED TO ASSIST DOE IN UNDERSTANDING THE RULES AND IN UNDERSTANDING THAT WHICH NRC CONSIDERS NECESSARY TO MEET THE RULES. WE HAVE ISSUED A REGULATORY GUIDE WHICH DESCRIBES THE INFORMATION NEEDED IN SITE CHARACTERIZATION PLANS IN ORDER FOR NRC TO EVALUATE THE PROPOSED TEST PROGRAMS. THIS GUIDE IS BEING REVISED TO BE CONSISTENT WITH NWPA REQUIREMENTS. WE WILL BE ISSUING ADDITIONAL GUIDES AS APPROPRIATE. FOR EXAMPLE, A GUIDE CONCERNING THE FORMAT FOR A LICENSE APPLICATION FOR A REPOSITORY IS UNDER DEVELOPMENT.

STAFF ALSO HAS BEEN WORKING ON GENERIC TECHNICAL POSITIONS IN SEVERAL AREAS, E.G., BOREHOLE AND SHAFT SEALS AND GROUND WATER TRAVEL TIME. IT ALSO HAS PROVIDED DOE WITH DRAFTS OF ISSUE-ORIENTED SITE TECHNICAL POSITIONS FOR EACH OF THE NINE POTENTIAL REPOSITORY SITES. THESE ARE BEING DISCUSSED WITH DOE.

AS DOE'S PROGRAM GOES FORWARD WE WILL PRODUCE APPROPRIATE ADDITIONAL, AS WELL AS REVISED, GUIDANCE. ATTACHMENT D IS A LISTING

OF GUIDANCE ISSUED AND PLANNED. THE GUIDANCE BASICALLY IS AIMED AT ASSURING THAT DOE HAS TIMELY INFORMATION SO THAT IT CAN PROVIDE AND SUBMIT TO NRC A HIGH QUALITY, COMPLETE APPLICATION WHICH WILL ENABLE AN EFFICIENT LICENSING PROCESS.

NRC PROPOSED ACTIVITIES FOR FY 86 & FY 87 FOR REPOSITORY PROGRAM

I WOULD LIKE TO REVIEW NOW OTHER ACTIVITIES CONCERNING THE REPOSITORY WHICH WE PLAN IN FY 86-87 IN ADDITION TO RULEMAKING.

THE MAIN WORK EFFORT WILL CONTINUE TO BE PRE-APPLICATION REVIEWS OF DOE'S SITE INVESTIGATIONS. WE WILL MAINTAIN CLOSE CONTACT WITH DOE, THE STATES, AFFECTED INDIAN TRIBES, AND TECHNICAL COMMUNITY AND INTERESTED MEMBERS OF THE GENERAL PUBLIC IN OUR CONTINUING EFFORT TO IDENTIFY AND RESOLVE ISSUES AT THE EARLIEST POSSIBLE DATE AND THUS MINIMIZE DELAYS.

REVIEWS OF TWO DOE DOCUMENTS WILL BE ESPECIALLY SIGNIFICANT IN REGARD TO THE SITING ACTIVITIES. ACTION ON ONE IS NEARING COMPLETION, I.E., REVIEW OF THE DRAFT ENVIRONMENTAL ASSESSMENTS DOE ISSUED FOR NINE POSSIBLE SITES FOR A REPOSITORY. THESE DRAFTS WERE RELEASED BY DOE ON DECEMBER 20, 1984, FOR A 90-DAY PUBLIC COMMENT PERIOD, WHICH ENDS IN MID-MARCH. NRC STAFF HAS A CONSIDERABLE EFFORT UNDERWAY TO REVIEW THESE DOCUMENTS. EACH OF THE NINE DOCUMENTS APPROACHES 1,000 PAGES IN LENGTH. EACH DOCUMENT IS SUPPORTED BY HUNDREDS OF REFERENCED DOCUMENTS. WE EXPECT TO PROVIDE COMMENTS ON THE DRAFTS TO DOE WITHIN THE PERIOD NOTED.

ANOTHER MAJOR ACTION WILL BE REVIEW OF EACH GENERAL PLAN FOR SITE CHARACTERIZATION ACTIVITIES WHICH DOE MUST PREPARE FOR EACH CANDIDATE SITE. THE SITE CHARACTERIZATION PLAN DOCUMENTS ARE EXPECTED IN 1986. NRC'S ABILITY TO COMMENT USEFULLY WILL BE SIGNIFICANTLY ENHANCED BY CONTINUING STAFF INTERACTION UNDER THE REPOSITORY AGREEMENTS I MENTIONED EARLIER, AS WELL AS EXPERIENCE IN REVIEWING THE ENVIRONMENTAL ASSESSMENT DOCUMENTS.

THERE ARE A NUMBER OF OTHER ACTIONS WHICH WE WILL BE PURSUING OVER THE NEXT YEAR OR SO. LET ME DESCRIBE THESE BRIEFLY.

DOE'S MISSION PLAN. THIS DOCUMENT IS REQUIRED BY SECTION 301 OF THE NWPA "TO PROVIDE AN INFORMATIONAL BASIS SUFFICIENT TO PERMIT INFORMED DECISIONS TO BE MADE IN CARRYING OUT THE REPOSITORY PROGRAM" AND THE R&D PROGRAMS REQUIRED UNDER THE ACT. PURSUANT TO THE SECTION'S REQUIREMENTS, NRC RECEIVED THE PLAN IN DRAFT FOR REVIEW LAST MAY, AND OUR COMMENTS WERE FORWARDED TO DOE LAST JUNE. WE UNDERSTAND THAT DOE EXPECTS TO SUBMIT THE FINAL DOCUMENT TO CONGRESS FAIRLY SOON. NRC STAFF WILL REVIEW IT TO IDENTIFY EFFECTS ON OUR ACTIVITIES AND SCHEDULES AND, RELATEDLY, RESOURCE REQUIREMENTS. WE ALSO WILL MONITOR UPDATES AS PREPARED BY DOE.

DOE'S PROJECT DECISION SCHEDULE. SECTION 114 REQUIRES DOE TO PREPARE AND UPDATE A SCHEDULE THAT PORTRAYS THE OPTIMUM WAY FOR ATTAINING OPERATION OF A NUCLEAR WASTE REPOSITORY WITHIN PRESCRIBED TIME PERIODS. THE ACT REQUIRES THAT THIS BE DONE IN COOPERATION WITH ALL AFFECTED FEDERAL AGENCIES. DOE PROPOSED A

PRELIMINARY DRAFT SCHEDULE FOR PROMPT REVIEW ON JANUARY 14, 1985. A FORMAL DRAFT IS EXPECTED WITHIN ABOUT A MONTH OR SO. THE FINAL DRAFT IS EXPECTED IN THE SUMMER. IN ADDITION TO PROVIDING INFORMATION ON WHICH TO BASE OUR OPERATIONAL PLANS, THE SCHEDULE ALSO CAN AFFECT HOW WE PROCEED IN PREPARING BUDGET REQUESTS.

DEFENSE WASTE DISPOSAL. LAST FALL, NRC COMMENTED ON DOE'S DRAFT REPORT WHICH CONCLUDED THAT, FOR REASONS OF COST ADVANTAGE, DEFENSE WASTES SHOULD BE DISPOSED OF IN A COMBINED COMMERCIAL AND DEFENSE REPOSITORY. WHILE WE HAVE NO FURTHER SCHEDULED ACTION AT THIS TIME IN THIS AREA, WE ARE MONITORING DOE'S ACTIONS. WE ARE AWAITING FURTHER DETAILS CONCERNING SUCH COMBINED REPOSITORY IN ORDER TO DETERMINE RESOURCE IMPACTS. THERE WOULD BE SIGNIFICANT REQUIREMENTS SHOULD THERE BE NEED FOR LICENSING A SEPARATE REPOSITORY FOR DEFENSE WASTES.

TEST & EVALUATION FACILITY (TEF). DOE HAS NOT YET ANNOUNCED WHETHER IT WILL PURSUE DEVELOPMENT OF A TEF, WHICH IS AUTHORIZED IN SECTION 213(A) OF THE NWPA. THE ACT CALLS FOR SEVERAL AREAS OF NRC/DOE INTERACTION, SHOULD A TEF BE BUILT. A WRITTEN AGREEMENT WOULD BE REQUIRED ON PROCEDURES FOR TEF INTERACTION. NRC WOULD BE REQUIRED TO CONDUCT A CONTINUING ANALYSIS OF TEF ACTIVITIES TO EVALUATE THE ADEQUACY OF THE CONSIDERATION OF PUBLIC HEALTH AND SAFETY ISSUES. NRC CONCURRENCE WOULD BE REQUIRED ON DECONTAMINATION AND DECOMMISSIONING OF DOE'S FACILITY.

ATTACHMENT E IS AN NRC STAFF ANALYSIS OF THE REQUIREMENTS OF THE NWPA. NRC'S SCHEDULING OF ITS ACTIVITIES UNDER THESE REQUIREMENTS IS CONTINGENT, TO A LARGE DEGREE, ON THE DOE SCHEDULING. ATTACHMENT F IS A LISTING OF PRINCIPLE NRC MILESTONES IN FY 86-87.

IN CONCLUDING MY PREPARED REMARKS, I WISH TO REEMPHASIZE THAT THE NRC INTEREST IN THE PROGRAM UNDER THE NWPA IS TO PROVIDE REGULATION WHICH WILL ASSURE THAT THE PUBLIC HEALTH AND SAFETY AND THE ENVIRONMENT ARE ADEQUATELY PROTECTED, AND THAT REGULATORY REQUIREMENTS WILL BE MET. NRC INTENDS TO EXERCISE ITS REGULATORY PROGRAM WITH RIGOR TO PROVIDE THIS ASSURANCE. WE BELIEVE A RIGOROUS REGULATORY PROGRAM IS ESSENTIAL FOR THE NECESSARY PUBLIC ACCEPTANCE OF THIS NATIONAL PROGRAM. AT THE SAME TIME, WE HAVE FASHIONED OUR PROGRAM -- ASSUMING WE OBTAIN SUFFICIENT RESOURCES -- SO THAT THIS REGULATION CAN BE EXERCISED EFFECTIVELY AND EFFICIENTLY.

THANK YOU.

ATTACHMENTS

A. NRC HLW TECHNICAL MEETINGS WITH DOE
B. FR 10 CFR PART 60 (FR VOL.46 NO.37)
C. MODIFICATIONS TO 10 CFR PART 60
D. NRC LICENSING GUIDANCE
E. NRC NUCLEAR WASTE POLICY ACT REQUIREMENTS
F. PRINCIPAL NRC NWPA ACTIVITIES FOR FY86-87

ATTACHMENT A

NRC HLW TECHNICAL MEETINGS WITH DOE

What follows is a listing of the technical meetings that have been held to date with DOE on the HLW repository program. The purpose of the technical meetings is to assure that an information flow is maintained between the NRC and DOE which facilitates the accomplishment by each agency of its responsibilities relative to site investigation and site characterization. Technical meetings are held to: review data; review and consult on interpretation of data; identify potential licensing issues; and to agree on the adequacy of methods and approaches for acquisition of information and data as well as available data. Schedules of activities pertaining to these technical meetings are made publicly available to all interested parties. A written report agreed to by both NRC and DOE is prepared for each meeting highlighting the agreements reached. Meetings are open to State/Tribal representatives and allows public attendance as observers.

BWIP WORKSHOPS AND TECHNICAL MEETINGS

MEETING	DATE
QA Visit	December 10-11, 1984
Geology Data Review	October 22-26, 1984
Geology Data Review	July 30-31, 1984

BWIP WORKSHOPS AND TECHNICAL MEETINGS (Continued)

MEETING	DATE
Hydrologic Characterization Plans	June 12-13, 1984
Waste Package Workshop	May 8-9, 1984
Geology Workshop	March 13-15, 1984
Rock Mechanics Data Review	January 23-26, 1984
Hydrologic Data Review	January 9-16, 1984
Geochemistry Workshop	January 9-12, 1984
Exploratory Shaft and Underground Testing	November 29-December 1, 1983
Performance Assessment	August 29-September 1, 1983

Hydrology Testing	July 11-15, 1983
Site Issue Meeting	June 13-16, 1983
Hydrology Meeting	June 7-10, 1983
Geology and Geologic Stability	April 12-15, 1983
Repository Design	October 5-7, 1982
Hydrologic Modeling of Pasco Basin	September 27-28, 1982
Waste Package	August 9-12, 1982
Geochemistry	August 9-12, 1982
Hydrology	July 21-27, 1982
Repository Design	July 6-11, 1982
Underground Testing Plans for the SCR	June 9-10, 1982
Hydrology	January 12-13, 1982
Site Technical and Program Review	September 22-24, 1981
Site Technical and Program Review	July 7-8, 1980

NNWSI WORKSHOPS AND TECHNICAL MEETINGS

MEETING	DATE
QA Visit	December 13-14, 1984
Geology Data Review	September 17-28, 1984
Hydrology Data Review	July 25-28, 1984
Design/Rock Mechanics Data Review	July 17-20, 1984
Geochemistry	July 10-13, 1984
Waste Package	October 18-19, 1983
Geology	October 4-6, 1983
Hydrology	September 20-21, 1983
Conceptual Design	January 24-25, 1983

Hydrology	January 18-19, 1983
Geochemistry	January 12-13, 1983
Site Technical and Program Review	May 17-19, 1982
Peer Review of NNWSI	August 24-28, 1981
Site Technical and Program Review	February 16-24, 1981
Site Technical and Program Review	September 24-25, 1979
Geochemistry and Hydrogeology	March 2, 1979

SALT WORKSHOPS AND TECHNICAL MEETINGS

QA Visit	December 18-19, 1984
Geophysics Data Review (Paradox Basin)	October 16-18, 1984
Geochemistry	August 22-24, 1984
Rock Mechanics Data Review	August 21-24, 1984
Performance Assessment	June 14-16, 1984
Site Security and Safeguards	May 23, 1984
Hydrology Data Review	May 14-18, 1984

SALT WORKSHOPS AND TECHNICAL MEETINGS (Continued)

MEETING	DATE
Repository Design, Exploratory Shaft, and In-Situ Testing	October 25-26, 1983
Waste Package Design and Performance	August 9-10, 1983
NRC Guidance on SCP Content	June 27-28, 1983
DOE Salt Project Overview	April 19-20, 1983
Review of the DOE Site Screening in Salt, Paradox Basin	May 11-21, 1981
Survey of Salt Dome Investigations	September 8-19, 1980

ATTACHMENT B

10 CFR Part 60 (FR Vol. 46, No. 37)

Rules and Regulations

Federal Register
Vol. 46, No. 37
Wednesday, February 25, 1981

This section of the FEDERAL REGISTER contains regulatory documents having general applicability and legal effect, most of which are keyed to and codified in the Code of Federal Regulations, which is published under 50 titles pursuant to 44 U.S.C. 1510.
The Code of Federal Regulations is sold by the Superintendent of Documents. Prices of new books are listed in the first FEDERAL REGISTER issue of each month.

NUCLEAR REGULATORY COMMISSION

10 CFR Parts 2, 19, 20, 21, 30, 40, 51, 60, and 70

Disposal of High-Level Radioactive Wastes in Geologic Repositories: Licensing Procedures

AGENCY: Nuclear Regulatory Commission.

ACTION: Final rule.

SUMMARY: The Nuclear Regulatory Commission (Commission or NRC) is publishing a final rule on the disposal of high-level radioactive wastes at geologic repositories. The rule sets forth requirements applicable to the Department of Energy for submitting an application for a license and specifies the procedures which the Commission will follow in considering such an application. The rule also sets forth provisions for consultation and participation in the license review by State, local, and Indian tribal governments.

EFFECTIVE DATE: March 27, 1981.

FOR FURTHER INFORMATION CONTACT: I. C. Roberts, Assistant Director for Siting Standards, Office of Standards Development, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Telephone (301) 443-5985.

SUPPLEMENTARY INFORMATION:

Background

On December 6, 1979, the Nuclear Regulatory Commission published for comment a proposed rule setting forth procedures for licensing geologic high-level radioactive waste (HLW) repositories to be constructed and operated by the Department of Energy (DOE) (44 FR 70408). The proposed rule superseded the proposed General Statement of Policy published for comment in November 1978 (43 FR 53869). Public comment on the proposed rule (10 CFR Part 60) was received from thirty-four groups and individuals. A number of changes and clarifications have been made in the rule as a result of comments received. This rule contains only the procedural requirements for licensing. The technical criteria against which the license application will be reviewed are still under development. The current staff thinking on the technical criteria was reflected in an Advance Notice of Proposed Rulemaking and draft technical criteria published for public comment on May 13, 1980 (45 FR 31393).

The Commission has made a formal determination that the final rule 10 CFR Part 60 satisfies the criteria for the approval of significant regulations set out in section 2(d) of Executive Order 12044.

Authority

Sections 202 (3) and (4) of the Energy Reorganization Act of 1974, as amended, provide the NRC with licensing and regulatory authority regarding DOE facilities used primarily for the receipt and storage [1] of the high-level radioactive wastes resulting from activities licensed under the Atomic Energy Act and certain other long-term, high-level waste storage facilities of the DOE. Pursuant to that authority, the Commission is promulgating regulations appropriate for licensing geologic disposal of HLW by the DOE. The requirement in the rule that DOE submit a Site Characterization Report in advance of performing exploration activities also implements Section 14(a) of the NRC Authorization Act of 1979 (Pub. L. 95-601).[2] DOE is responsible for developing the methods and technology for the permanent disposal of high-level radioactive waste in a Federal repository, and for submitting a license application for a potential repository.

The licensing procedures in this rule will be supplemented by technical criteria which will be developed by the Commission in the light of such generally applicable environmental standards as may have been established by the Environmental Protection Agency under Reorganization Plan No. 3 of 1970.

Questions have been raised in the past about the authority of NRC to regulate the construction of the waste repository. DOE activities that take place before an application if filed and may affect the long-term safety of the repository obviously may preclude receipt of a construction authorization. The Commission has concluded that NRC may use its powers to regulate construction of the repository. Accordingly, the Commission may, if necessary, issue orders to secure compliance with construction authorization conditions and to protect the integrity of the repository. In addition, failure to comply with the conditions of any construction authorization may also be grounds for denial of a license to receive material.

Comments

A total of thirty-four groups and individuals commented on the proposed rule, addressing a variety of issues. Most of the commenters viewed the proposed rule as a significant improvement over the proposed General Statement of Policy, and, generally, the comments were supportive of the principles and procedures outlined in the proposed rule. The principal comments received related to multiple site characterization, in situ testing at depth, cost estimates for site characterization, whether the rule should require that the site selected by DOE be the "best", whether an environmental impact statement (EIS) should be required for site characterization, whether the Commission should prepare an EIS for this rulemaking action, opportunities for State, local and public participation, formal public hearings, the preliminary nature of some information to be included in an application for construction authorization, and the termination of a license following decommissioning. Summaries of the comments received on these issues are presented below. Copies of the comments and an analysis of them by the NRC staff are available in the Commission's Public Document Room.

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[1] The Commission interprets "storage" as used in the Energy Reorganization Act to include disposal.

[2] Section 14(a) reads as follows: Any person, agency, or other entity proposing to develop a storage or disposal facility, including a test disposal facility, for high-level radioactive wastes, non-high-level radioactive wastes including transuranium contaminated wastes, or irradiated nuclear reactor fuel, shall notify the Commission as early as possible after the commencement of planning for a particular proposed facility. The Commission shall in turn notify the Governor and the State legislature of the State of proposed situs whenever the Commission has knowledge of such proposal.

Some of the commenters raised issues that will be covered in the technical criteria: those will be dealt with in connection with the ongoing rulemaking for those criteria.

a. *Site Characterization.* Comments on site characterization straddled the Commission position set forth in the proposed rule. Some commenters agreed with the requirement for multiple site characterization as presented in the proposed rule. Some commenters expressed the opinion that multiple site characterization was not required for the Commission to fulfill its NEPA obligation to consider alternatives. The Commission has carefully reviewed arguments presented by the commenters who stated that multiple site characterization is not necessary. The Commission continues to believe that required multiple site characterization provides the only effective means by which it can make a comparative evaluation as a basis for arriving at a reasoned decision under NEPA. Other commenters believed that the requirements for multiple site characterization were not stringent enough, and suggested that the rule specify the number of geologic media and sites to be characterized by the DOE. The Commission continues to believe that characterization of several sites will prevent a premature commitment by DOE to a particular site, and will assure that DOE's preferred site will be chosen from a slate of candidate sites that are among the best that can reasonably be found. The Commission considers three sites in two geologic media, at least one of which is not salt, to be the minumum number needed to satisfy NEPA. That is, the Commission can foresee no circumstance that would permit it to conclude, on the basis of a more limited investigation, that alternatives have been considered in accordance with the "rule of reason." Further it is the present judgment of the Commission that for purposes of making a reasoned choice there is not sufficient difference between bedded salt and domed salt for them to be considered two distinct alternative media. However, because the "rule of reason" is intrinsically flexible, the Commission does not believe that it would be appropriate for these regulations to specify more than the minimum number or type of geologic media and sites that DOE must characterize during multiple site characterization. What is important is that there be sufficient information for NRC to be able to evaluate real alternatives, in a timely manner, in accordance with NEPA.

Information on plans for considering alternative sites is to be included in the Site Characterization Report. This provision was questioned by some commenters. This information is needed so that any deficiency may be the subject of "specific recommendations" by the Director of the NRC's Office of Nuclear Material Safety and Safeguards, (Director) as provided in § 60.11(e), with respect to additional information that might be needed by the Commission in reviewing a license application in accordance with NEPA.

Another commenter raised the issue that in addition to the need to consider alternatives under the provisions of NEPA, the need for characterizing several sites in a variety of media is also justified by NRC's obligation under the Atomic Energy Act to protect public health and safety. The Commission recognizes that, under the provisions of the Atomic Energy Act, a consideration of alternatives might indeed be appropriate, where necessary or desirable to protect health. (Section 161g.) The Commission cannot say at this point that an examination of alternatives would be essential for this purpose. The Commission anticipates that its fundamental licensing inquiry in the context of evaluating radiological safety issues will be directed to determining whether the activities proposed by the DOE can be carried out in a manner consistent with generally applicable environmental standards established by the Environmental Protection Agency.

The Commission also continues to believe that waste form research is an appropriate topic for treatment in the Site Characterization Report, as the discussion may lead to specific recommendations by the Director, and, as well, contribute to early examination and broader understanding of possible waste form/host rock interactions. Further, wording of § 60.11(a) has been changed from "waste form" to "waste form and packaging" to convey better the concept that the NRC will seek information relating to the interaction of the waste as emplaced (hence including packaging) with the host rock.

In response to one commenter's suggestion that the Site Characterization Report be made to NRC on a site by site basis, § 60.11(a) has been revised to require DOE to submit a separate Site Characterization Report for each site to be characterized.

There were also suggestions that the distinction between site characterization and screening activities be drawn more sharply. However, because the activities needed prior to characterization may depend on a variety of factors peculiar to the site and geologic medium, the Commission has concluded that greater precision might be unduly restrictive.

The DOE requested clarification of the term "site". Definitions of both the terms "site" and "medium" will be set forth when the technical criteria are published.

b. *In Situ Testing at Depth.* Several commenters supported the Commission view on in situ testing at depth. Some commenters, noting the importance of in situ testing at depth, suggested that the rule require the DOE to include in situ testing at depth in its site characterization program. The U.S. Geological Survey (USGS) supported required in situ testing at depth at a number of sites prior to NRC adjudicatory hearings, so that such hearings could proceed on the basis of critical, site-specific data on the candidate host rocks and environs rather than on inferences derived from a limited number of drill holes supplemented by geophysical techniques. The USGS expressed the opinion that direct observation and in situ testing of host media will be the only way to characterize sites with confidence. Several other commenters objected to the Commission suggestion that in situ testing at depth may be necessary. The possibility of in situ testing at depth after a preferred repository site has been selected was also suggested.

The Commission, like the USGS, believes that in situ testing at depth[2] is an essential technique for DOE to obtain sufficient data to determine whether and to what extent the surrounding geologic medium is suitable for hosting a geologic repository. This belief is supported by the ever-present possibility of lateral changes in the properties of the host rock and the possible presence of inhomogeneities of too small a scale to be detected by remote or borehole techniques. Moreover, in order for NRC to be able to conclude that the alternatives to DOE's preferred site are in fact reasonable alternatives for the intended purpose, in situ testing at depth is essential to characterizing alternative sites as well. The NRC will then be able to determine, after considering all relevant environmental factors as contemplated by NEPA, whether a construction authorization at DOE's proposed site should be issued. Thus. the Commission requires in situ testing at depth in the rule. It is conceivable. however. that techniques may be developed to obtain the necessary data at a particular site without in situ testing at depth. In such a case DOE may request an exemption from the in situ testing at depth requirement. DOE. like any applicant for an NRC license. has the burden of establishing that NRC requirements have been met: and the regulations require DOE to undertake any testing needed to determine the suitability of the site for a geologic repository. Thus. if exploration and in situ testing at depth were not undertaken. DOE would still have the same burden of obtaining and supplying to the Commission information needed to establish the suitability of the site.

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[2] The Commission interprets the phrase "in situ testing at depth" to mean the conduct of those geophysical, geochemical, hydrologic, and/or rock mechanics tests performed from a test area at the base of a shaft excavated to the proposed depth of a potential repository in order to determine the suitability of a particular site for a geologic repository.

c. *Cost Estimates for Site Characterization.* Cost estimates for site characterization cited in the Supplementary Information accompanying the proposed rule were regarded by some commenters as being too low. Much of the data for the cost estimate of $20 million per site was derived from the Teknekron Inc. report. "A Cost Optimization Study for Geologic Isolation of Radioactive Wastes." May 1979. prepared under contract with Battelle Pacific Northwest Laboratories. The NRC staff has reexamined its previous estimate and still believes that figure of $20 million was a realistic estimate for the "at depth" portion of the site characterization program considered at that time. Independent support of this figure has been obtained from the cost summary of $16 million for a program during 1978–1979 analogous to site characterization conducted by the Bureau of Mines at its Environmental Research Facility in Colorado.

The DOE has developed a preliminary design for an underground test facility in New Mexico at which many site characterization activities could be conducted. The estimated cost of the facility was $27 million (1980 dollars). This figure has been confirmed by American Mine Services under contract to NRC. The scope of the DOE preliminary design surpasses the extent of activities suggested for the "at depth" portion of site characterization in the proposed rule. For example. the DOE Site Preliminary Verification Project Plan includes extensive underground mining development. The Commission has come to believe. however. that a facility consisting of two shafts and up to 1.000 feet of tunnels is a more practical arrangement for conducting tests and experiments at depth for site characterization. Therefore. the Commission believes a $25–30 million figure represents the upper limit for the "at depth" portion of site characterization in soft rock. Cost estimates for site characterization including in situ testing at depth in hard rock may range up to 30% more than cost figures for soft rock.

d. *The "Best" Site.* Some commenters suggested that the final rule should require that the site selected by the DOE be the "best". Yet other commenters thought that the Commission was setting an unattainable goal of perfection for the selection of the site for a geologic repository. It remains the Commission's view that the process of multiple site characterization provides a workable mechanism by which the DOE will be able to develop a slate of candidate sites that are among the best that can reasonably be found and from which DOE will select its preferred site.

It generally has been NRC practice to consider only whether a license application meets prescribed criteria. The Commission perceives no reason to adopt a different philsoophy here.

e. *Environmental Impact Statement.* Some commenters believed that the NRC should require that the DOE submit an Environmental Impact Statement (EIS) at the site characterization stage. Other commenters believed that DOE need only submit an Environmental Report or an Envirionmental Assessment for site characterization. In its comment letter on the proposed rule. the DOE stated that a decision to bank or withdraw a site or to conduct a site characterization by more extensive methods such as sinking a shaft will require the preparation of an EIS. In any event. since NRC is undertaking no "major Federal action" in connection with site characterization. it has no statutory basis for prescribing what steps DOE must take in order to be in compliance with NEPA.

The rule requires submission of an Environmental Report along with the Safety Analysis Report at the time of application for a license. If DOE has prepared an EIS that document can be used so long as it contains the information called for by the regulation. However. NRC cannot be bound to accept judgments arrived at by DOE in its EIS.

One commenter suggested that the NRC should prepare an EIS for the rulemaking action. The Commission determined that this was not necessary as part of its review and approval of publication of the proposed rule. Instead. an Environmental Impact Appraisal was prepared for those requirements which might have environmental impacts. Those impacts were found not to be significant. This Environmental Impact Appraisal has recently been updated and no new impact was found to be significant. A copy of the updated appraisal is available for inspection and copying at the Commission's Public Document Room.

f. *State. Local. and Public Participation.* The proposed rule included detailed provisions to ensure extensive opportunities for participation by State and local governments and the general public in the review of the DOE's programs for site selection and site characterization. The consultation role of the States in reviewing applicable NRC regulations and licensing procedures. as well as participation in the licensing process. was treated explicitly in the proposed rule. However. a more formal role of "consultation and concurrence" for States was requested by some commenters. Suggestions were also made that the Commission require the DOE to solicit input from State. Indian tribal and local governments as well as from the general public prior to and during site characterization.

The Commission's views on this subject were set out at length in a report submitted to the Congress on "Means for Improving State Participation in the Siting. Licensing and Development of Federal Nuclear Facilities." NUREG–0539. March 1979. cited in the Supplementary Information accompanying the proposed rule. The concerns of the commenters on broad policy issues such as "consultation and concurrence" would require actions by parties other than the Commission. Within the context of NRC's existing authority. appropriate opportunities for meaningful State and public participation have been developed. No serious deficiencies in these opportunities have been pointed out to the NRC. In addition. the provisions of the NRC's open meeting policy set forth at 43 FR 28058 (June 28. 1978) will also be applied to the licensing of a geologic repository to the extent practicable. Under this policy. generally. all meetings conducted by the NRC technical staff as part of its review of a particular domestic license or permit application will be open to attendance by all parties or petitioners for leave to intervene in the case. The Commission strongly encourages the Director to conduct open meetings prior to a license application to the extent reasonable for matters such as periodic status reports and similar proceedings.

It should be noted. however. that proposals for intervenor funding have not been incorporated as suggested by some commenters. This question may be addressed separately in the context of rulemaking applicable to various adjudicatory proceedings. should the Commission be given statutory authority. which it now lacks. to provide such funding.

In response to commenters' suggestions. the rule has been clarified with respect to notice to and participation by Indian tribes.

g. *Public Hearings.* The issue of whether public hearings should be mandatory during the pre-licensing and/or licensing stages of geologic disposal of HLW was addressed by a numbers of commenters. Two commenters suggested that hearings be required prior to site characterization. One commenter suggested that public hearings should be held in the vicinity of a proposed site prior to the approval of a Site Characterization Report. while another commenter suggested that hearings be held prior to in situ testing at depth. It was also proposed by another commenter that public hearings be held on DOE's research and development work on waste forms. Finally. two other commenters believed that formal hearings should be mandatory prior to granting construction authorization to DOE. These issues were discussed at the time the rule was proposed. The Commission then concluded. in light of the limited information available at the site characterization stage. that formal hearings were not warranted at that point. The commenter did not deny the relevance of the policy considerations identified by the Commission. but would have balanced these considerations differently. But this is a matter of judgment. and the NRC adheres to its original position for the reasons then offered. Also. the NRC must decline to review DOE research and development programs formally. NRC's statutory authority includes "licensing and related regulatory authority" as to certain DOE facilities. Although it is important to follow DOE's program closely. the Commission would not be warranted in formalizing a review process with respect to that program.

In reviewing the procedures for formal proceedings in connection with licensing. the Commission has determined that hearings would be in the public interest prior to the granting of construction authorization. An amendment (in § 2.101(f)(8)) has the effect of mandating such hearings. In addition. hearings will be held upon the request of any interested person prior to finally granting a license to receive and possess high-level radioactive waste at a geologic repository operations area and before granting license amendments to decommission or terminate a license.

As in the case of facility licensing matters. ex parte communications would be restricted while on-the-record proceedings are pending. Because a construction authorization (unlike a construction permit) is not a license. its issuance does not constitute a final decision on the pending application. To avoid any unintended implication that the ex parte rule (10 CFR 2.780) would apply between the construction authorization proceedings and the commencement of formal proceedings prior to receipt of wastes. that rule has been amended to provide specifically that a final decision with respect to issuance of construction authorization will be deemed. unless the Commission orders otherwise. to terminate. for purposes of the ex parte rule. formal proceedings then pending before the NRC with respect to the application.

The rule has also been revised to provide that in cases involving public hearings. the initial decision of the presiding officer shall not be immediately effective. (§ 2.764.) It is further provided that even if no hearing has been held. the Director of Nuclear Material Safety and Safeguards will not issue a construction authorization. license. or significant amendment until expressly authorized to do so by the Commission. The Commission has not yet determined the specific procedures for agency review of an initial decision. It will be the Commission's intention. however. to provide expeditious action on an initial decision to avoid any undue delays in the licensing process. These changes. while not issued in direct response to commenters' suggestions. reflect sentiments that the Commission itself should be involved in major decisions on these facilities.

h. *Preliminary Nature of the Information to be Included in an Application for Construction Authorisation.* A number of commenters expressed the opinion that the wording of § 60.21 did not explicitly reflect the preliminary nature of some of the information that would be available at the construction authorization stage. Some commenters believed that certain categories of information. such as emergency plans and plans for retrieval. did not seem necessary. at least in full detail. at the construction authorization stage. In view of the fact that § 60.21 must be read in conjunction with § 60.24(a). which specifies that the application "shall be as complete as possible in light of information that is reasonably available at the time of docketing." no change to the proposed rule is required. Further. § 60.24(b) specifically lists several categories of information which. where appropriate. may be left for consideration only at the state of license issuance.

i. *Termination of a License.* Two commenters opposed the provisions (§ 60.52) for the termination of a license for a repository after decommissioning. The Commission believes that there will be considerable debate regarding license termination during the period between adoption of rules and implementation of their provisions. Although the Commission could have omitted the topic altogether. it believes that some recognition of the issue is desirable so that the rule covers the entire process. It should be noted that there is no assurance under the language that the license would be terminated since a decision to do so could only be made if "authorized by law." The Commission wishes to emphasize that criteria to be used in making a decision to decommission a repository are not included in this procedural rule but will be set forth either within the technical criteria of Part 60 or as a future regulation or policy statement.

Changes

The final rule contains the following changes from the proposed rule as published in December 1979.

a. *Definition of the term "Disposal".* Commentors noted that the proposed definition of the term "disposal" embodied the contradictory concepts of "permanent emplacement" and possible retrieval for purposes other than resource value. The definition has been modified to reflect usage of the term "disposal" in the rule as the condition in which isolation is required. (§ 60.2(f))

b. *Incidental Uses of Radioactive Materials.* The DOE noted that the proposed rule could have the effect of prohibiting the use of source. special nuclear. and byproduct materials at the site during site characterization and facility construction. The DOE referred to the desirability of being able to use such materials. for example. as radiography sources and radiation monitoring test sources. There may also be a need to employ a small amount of radiactive material for in situ testing in the course of site characterization activities.

The Commission did not intend to restrict DOE's use of radioactive materials for the stated purposes. and has clarified the point by adding a new section. § 60.7. which expressly recognizes that DOE (which is exempt from NRC licensing except as expressly required to be licensed) need not be licensed for such preliminary activities. This is not an exemption under the exemption provisions of the Atomic Energy Act. but rather an interpretation of the Commission's jurisdiction under Section 202 of the Energy Reorganization Act of 1974. In other words. the "facility" that the NRC is licensing is one at which high-level radioactive wastes are actually stored. To the extent that the procedures call for earlier NRC involvement. that involvement would be undertaken with a view to long-term health and safety considerations: but during site characterization and prior to emplacement of waste. there would be no "facility" for storage of high-level waste and no basis for the exercise of licensing authority over the incidental use of source. special nuclear. and byproduct material by DOE.

Once operations at a facility have been licensed. the Commission believes it should regulate the use of all licensable materials onsite. so as to avoid fragmentation of responsibility and accountability with respect to radiological safety (particularly as it may affect occupational exposures).

The change does not respond to the DOE's additional concern that the proposed rule would prohibit construction and operation of a surface facility for the storage of spent reactor fuel at a repository site prior to issuance of a Part 60 license. Should this situation actually arise in practice. the Commission would consider granting an exemption so as to permit licensing to be carried out under other parts of NRC regulations.

c. *Site Characterization.* Following detailed consideration of public comments. the Commission has decided to require in situ testing at depth and to specify the minimum number of sites to be considered as alternatives during site characterization.

d. *Site Characterization Report.* One commenter on the proposed rule suggested that the description of the DOE's planned site characterization program include a preliminary design of the repository. Knowledge of the proposed design would help indicate how the testing program related to the repository layout. The Commission has made it explicit that the Site Characterization Report include a conceptual design of the geologic repository operations area. This is needed so as to permit analysis of certain aspects of the site characterization program. (§ 60.11(a).)

The provisions of § 60.11(a) have been modified by the addition of a footnote to indicate that information on the criteria and methods used for site selection. identification and location of alternative sites and media. and the decision process used to select the site. including means used to obtain State. Indian tribal and public views. which all can be expected to be in DOE's Environmental Impact Statement for site characterization. need not be duplicated in the Site Characterization Report. but can be incorporated by reference.

§ 60.11(e) has been modified to state explicitly that a copy of NRC's final site characterization analysis and the Director's opinion will be transmitted to DOE.

The provisions of § 60.11(g) have been changed to require DOE to permit NRC staff to visit and inspect the site and observe excavations. borings. and in situ tests as they are done. The NRC believes that such a requirement is essential for NRC to determine that site characterization activities have no adverse impacts upon site safety.

The proposed rule contained provisions which would permit the DOE to include multiple sites in a single Site Characterization Report. In response to public comment. and for the sake of clarity. the final rule requires a separate Site Characterization Report for each site to be characterized.

The Commission reiterates that the Site Characterization Report will be reviewed by the NRC staff with opportunity for public comment on the NRC staff analysis of the DOE Site Characterization Report. DOE has indicated that it will provide opportunity for public comment on its Site Characterization Report prior to submittal to the NRC. Also. the Commission continues to anticipate that it will hold local public meetings in the immediate area of the site to be characterized. These meetings will be held both to disseminate information and to obtain public input which will be factored into the final version of the staff analysis.

The period for comment on the NRC's draft site characterization analysis has been extended from a minimum of 60 days to a minimum of 90 days in response to public comment. (§ 60.11(e))

The provision concerning semiannual progress reports has been expanded so as to provide additional guidance to the DOE on the contents of those reports. (§ 60.11(g)) In addition. § 60.11(g) now contains a provision which requires DOE to provide in report form. any information related to site characterization. when requested by the Director.

The rule has been revised to permit the Director to comment at any time in writing to DOE to express views on any aspect of site characterization (§ 60.11(h)).

e. *Content of License Application.* Provisions which set forth the general information to be included in an application have been expanded to include a description of site characterization work actually conducted by DOE at all sites considered and. as appropriate. explanations of why such work differed from the description of program in the Site Characterization Report for each site (60.21(b)(5)). It is expected that such a provision will facilitate the evaluation of DOE's site characterization by the public.

f. *Construction Authorization Findings.* The necessary findings by the Commission on environmental matters (§ 60.31(c)) have been revised to conform to the language in other portions of the Commission's regulations. Contrary to the views expressed by a commenter. the Commission regards this provision as being fully consistent with the requirements of NEPA. Further specificity may be provided. however. particularly with respect to the criteria for evaluating alternative sites at the time technical criteria are proposed.

The Commission has declined to modify the common defense and security finding. which one commenter characterized to be "so vague as to be of no consequence." The proposed "inimicality" findings. §§ 60.31(b) and 60.41(c). reflect the legal standards set forth in the Atomic Energy Act. in particular Section 57c.(2) thereof. The concerns here related generally to protection of classified information and materials. protection against loss or diversion of nuclear waste materials from the repository. and protection against radiological sabotage at the repository. Detailed regulations appear in other parts of this chapter on protection of classified matters and no further special provisions appear to be required for Part 60. See 10 CFR Part 2. subpart I. Part 25. Part 95. Radiation hazards associated with high-level radioactive wastes make them inherently unattractive as a target for diversion. and therefore no detailed provisions appear to be warranted at this time for protection against loss or diversion. The rule has been changed to require DOE to describe the elements of its plan to protect against sabotage. However. DOE. as a Federal agency operating under the Atomic Energy Act. has its own obligation to promote the common defense and security. Indeed. DOE is responsible under the Atomic

Energy Act for protection of materials and facilities far more sensitive from a safeguards standpoint than nuclear waste materials in a geologic repository. Therefore, the rule provides that a DOE certification that its repository operations area safeguards are equal to those at comparable DOE surface facilities shall constitute a rebuttable presumption on the question of inimicality to the common defense and security.

g. *Conditions of Construction Authorization.* The final rule specifies (§ 60.32(b)) that the construction authorization "will incorporate" conditions requiring the submission of certain periodic or special reports. This wording differs from that of the proposed rule which stated that the Commission "may, at its discretion incorporate" these conditions. The NRC agrees with a commenter that such reports will be needed and that there is no reason to reserve discretion, as the proposed rule would have done. The particulars of the conditions would, of course, depend upon the nature of the project that is to be constructed.

A new paragraph 60.32(c) has been included in the final rule to inform DOE that the construction authorization will include restrictions on subsequent changes to the features of the repository and the procedures authorized. These restrictions will fall into three categories of descending importance to public health and safety as follows: (1) those features and procedures which may not be changed without (i) 60 days prior notice to the Commission, (ii) 30 days notice of opportunity for a prior hearing, and (iii) prior Commission approval; (2) those features and procedures which may not be changed without (i) 60 days prior notice to the Commission, and (ii) prior Commission approval; and (3) those features and procedures which may not be changed without 60 days prior notice to the Commission. Features and procedures falling in category (3) may not be changed without prior Commission approval if the Commission, after having received the required notice, so orders.

Not every feature and procedure in the license application at the time the construction authorization is issued would need to be included in one of the three categories. There will be a number of matters that could be changed as construction progresses without prior notice to the Commission. Such changes would be brought to the Commission's attention when the license application is updated prior to issuance of a license to receive wastes. Also, it is contemplated that changes to features or procedures included in these categories of license conditions considered minor with respect to the public health and safety, could be made with prior notice to the Commission but without prior Commission approval.

h. *License Specifications.* The Commission has accepted a suggestion to delete a requirement for including, as license conditions, restrictions as to the location and characteristics of the storage medium. As noted by a commenter, these features may be inherent in the storage medium itself.

i. *Inspections.* The final rule contains a provision (§ 60.73(c)) requiring DOE to provide onsite office space for the exclusive use of NRC inspectors and personnel.

j. *Participation of Indian Tribes.* Several changes have been made in the rule to provide for full participation by Indian tribes in the licensing procedures. These changes generally provide that tribes shall have the same opportunities as governmental units. A new Section 60.64 provides that Indian Tribes shall have the same opportunities as States to submit proposals for their participation in the NRC review. These proposals shall be approved (and may be funded) if appropriate findings can be made concerning the contribution to be made to the licensing review. A new Section 60.65 makes it clear, however, that the Director shall endeavor to avoid duplication of effort when acting on multiple proposals, to the extent that this can be accomplished without substantial prejudice to the parties involved.

k. *Preparation of an Environmental Impact Statement prior to issuance of license to receive and possess HLW.* The requirement that the NRC prepare and circulate an EIS prior to issuing a license to receive and possess HLW has been deleted (51.5(a)(11)). Since an EIS will be prepared by NRC prior to granting construction authorization for a geologic respository operations area, it may not be necessary to prepare a second EIS. Rather, after the construction authorization stage, the NRC will perform environmental assessments, and, as appropriate, will supplement the EIS or determine that no such supplemental statement is required.

l. *Records and Tests.* The term "significant" has been deleted from Section 60.71(c)(3). The Commission requires notification of all deviations from license conditions.

m. *Definition of the term "Commission."* A definition of the term "Commission" has been added to the final rule to make it clear that in Part 60, the "Commission" means the Nuclear Regulatory Commission or its duly authorized representatives.

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974, as amended, Public Law 95-601 (November 6, 1978), the National Environmental Policy Act of 1969, as amended, and sections 552 and 553 of title 5 of the United States Code, notice is hereby given that the following amendments to Title 10, Chapter I, Code of Federal Regulations are published as a document subject to codification.

PART 2—RULES OF PRACTICE

1. Section 2.101 is amended to add a new paragraph (f) to read as follows:

§ 2.101 Filing of application.

* * * * *

(f)(1) Each application for a license to receive and possess high-level radioactive waste at a geologic repository operations area pursuant to Part 60 of this chapter and any environmental report required in connection therewith pursuant to Part 51 of this chapter shall be processed in accordance with the provisions of this paragraph.

(2) To allow a determination as to whether the application or environmental report is complete and acceptable for docketing, it will be initially treated as a tendered document, and a copy will be available for public inspection in the Commission's Public Document Room. Twenty copies shall be filed to enable this determination to be made.

(3) If the Director of Nuclear Material Safety and Safeguards determines that the tendered document is complete and acceptable for docketing, a docket number will be assigned and the applicant will be notified of the determination. If it is determined that all or any part of the tendered document is incomplete and therefore not acceptable for processing, the applicant will be informed of this determination and the respects in which the document is deficient.

(4) The Director may determine the environmental report to be not complete and therefore not acceptable for processing if it fails to include the required site characterization data, including the results of appropriate in situ testing at depth for each site characterized, with respect to the number of sites and media specified in § 51.40 of this chapter. If such a determination is made, the Director shall request the DOE to submit, within a specified time, such characterization data as the Director determines to be

necessary. If the DOE fails to provide the requested data within the time specified, the application shall be subject to denial under § 2.108.

(5) With respect to any tendered document that is acceptable for docketing, the applicant will be requested to (i) submit to the Director of Nuclear Material Safety and Safeguards such additional copies as the regulations in Parts 60 and 51 require, (ii) serve a copy on the chief executive of the municipality in which the geologic repository operations area is to be located or, if the geologic repository operations area is not to be located within a municipality, on the chief executive of the county (or to the Tribal organization, if it is to be located within an Indian reservation), and (iii) make direct distribution of additional copies to Federal, State, Indian Tribe, and local officials in accordance with the requirements of this chapter and written instructions from the Director of Nuclear Material Safety and Safeguards. All such copies shall be completely assembled documents, identified by docket number. Subsequently distributed amendments, however, may include revised pages to previous submittals and, in such cases, the recipients will be responsible for inserting the revised pages.

(6) The tendered document will be formally docketed upon receipt by the Director of Nuclear Material Safety and Safeguards of the required additional copies. The date of docketing shall be the date when the required copies are received by the Director of Nuclear Material Safety and Safeguards. Within ten (10) days after docketing, the applicant shall submit to the Director of Nuclear Material Safety and Safeguards a written statement that distribution of the additional copies to Federal, State, Indian Tribe, and local officials has been completed in accordance with requirements of this chapter and written instructions furnished to the applicant by the Director of Nuclear Material Safety and Safeguards. Distribution of the additional copies shall be deemed to be complete as of the time the copies are deposited in the mail or with a carrier prepaid for delivery to the designated addressees.

(7) Amendments to the application and environmental report shall be filed and distributed and a written statement shall be furnished to the Director of Nuclear Material Safety and Safeguards in the same manner as for the initial application and environmental report.

(8) The Director of Nuclear Material Safety and Safeguards will cause to be published in the **Federal Register** a notice of docketing which identifies the State and location at which the proposed geologic repository operations area would be located and will give notice of docketing to the governor of that State. The notice of docketing will state that the Commission finds that a hearing is required in the public interest, prior to issuance of a construction authorization, and will recite the matters specified in § 2.104(a) of this part.

2. Section 2.103(a) is revised to read as follows:

§ 2.103 Action on applications for byproduct, source, special nuclear material, and operator licenses.

(a) If the Director of Nuclear Reactor Regulation or the Director of Nuclear Material Safety and Safeguards, as appropriate, finds that an application for a byproduct, source, special nuclear material, or operator license complies with the requirements of the Act, the Energy Reorganization Act, and this chapter, he will issue a license. If the license is for a facility or for receipt of waste radioactive material from other persons for the purpose of commercial disposal by the waste disposal licensee, or if it is to receive and possess high-level radioactive waste at a geologic repository operations area pursuant to Part 60 of this chapter, the Director of Nuclear Reactor Regulation or the Director of Nuclear Material Safety and Safeguards, as appropriate, will inform the State, Indian Tribe, and local officials specified in § 2.104(e) of the issuance of the license.

* * * * *

3. Section 2.104(e) is revised to read as follows:

§ 2.104 Notice of hearing.

* * * * *

(e) The Secretary will give timely notice of the hearing to all parties and to other persons, if any, entitled by law to notice. The Secretary will transmit a notice of hearing on an application for a facility license or for a license for receipt of waste radioactive material from other persons for the purpose of commercial disposal by the waste disposal licensee or for a license to receive and possess high-level radioactive waste at a geologic repository operations area pursuant to Part 60 of this chapter to the Governor or other appropriate official of the State and to the chief executive of the municipality in which the facility is to be located or the activity is to be conducted or, if the facility is not to be located or the activity conducted within a municipality, to the chief executive of the county (or to the Tribal organization, if it is to be so located or conducted within an Indian reservation).

4. Section 2.105(a) is amended by adding new paragraphs (4) and (5), redesignating existing paragraph (4) as (6) amending the paragraph redesignated as (6), numbering the existing undesignated paragraph following renumbered paragraph (6) as (7) and adding a new final paragraph (8) to read as follows:

§ 2.105 Notice of proposed action.

(a) If a hearing is not required by the Act or this chapter, and if the Commission has not found that a hearing is in the public interest, it will, prior to acting thereon, cause to be published in the **Federal Register** a notice of proposed action with respect to an application for:

* * * * *

(4) A license to receive and possess high-level radioactive waste at a geologic repository operations area pursuant to Part 60 of this chapter;

(5) An amendment to a license specified in paragraph (a)(4) of this section, or an amendment to a construction authorization granted in proceedings on an application or such a license, when such amendment would authorize actions which may significantly affect the health and safety of the public; or

(6) Any other license or amendment as to which the Commission determines that an opportunity for a public hearing should be afforded.

(7) In the case of an application for an operating license for a facility of a type described in § 50.21(b) or § 50.22 of this chapter or a testing facility, a notice of opportunity for hearing shall be issued as soon as practicable after the application has been docketed.

(8) In the case of an application for a license to receive and possess high-level radioactive waste at a geologic repository operations area, a notice of opportunity for hearing, as required by this paragraph, shall be published prior to Commission action authorizing receipt of such wastes; this requirement is in addition to the procedures set out in § 2.101(f)(8) and § 2.104 of this part, which provide for a hearing on the application prior to issuance of a construction authorization.

5. 10 CFR 2.105(e) is revised to read as follows:

* * * * *

(e) If no request for a hearing or petition for leave to intervene is filed within the time prescribed in the notice, the Director of Nuclear Reactor Regulation or Director of Nuclear Material Safety and Safeguards, as appropriate, may take the proposed action, inform the appropriate State and local officials. and cause to be published in the **Federal Register** a notice of issuance of the license or other action. If a request for a hearing and/or a petition for leave to intervene is filed within the time prescribed in the notice. the Commission or an atomic safety and licensing board designated by the Commission or by the Chairman of the Atomic Safety and Licensing Board Panel will rule on the request and/or petition and the Secretary or the designated atomic safety and licensing board will issue a notice of hearing or an appropriate order.

* * * * *

6. Section 2.106 is amended by adding a new paragraph (c) to read as follows.

§ 2.106 Notice of issuance.

* * * * *

(c) The Director of Nuclear Material Safety and Safeguards will also cause to be published in the **Federal Register** notice of. and will inform the State. local. and Tribal officials specified in § 2.104(e) of any action with respect to. an application for a license to receive and possess high-level radioactive waste at a geologic repository operations area pursuant to Part 60 of this chapter. or for the amendment to such license for which a notice of proposed action has been previously published.

7. Section 2.764 is amended by revising the caption. by adding a new paragraph (d). and by making conforming changes to paragraphs (a) and (b) to read as follows:

§ 2.764 Immediate effectiveness of certain initial decisions.[6]

(a) Except as provided in paragraphs (c) and (d) of this section. an initial decision * * *

(b) Except as provided in paragraphs (c) and (d) of this section. the Director of Nuclear Reactor Regulation or Director of Nuclear Material Safety and Safeguards * * *

* * * * *

(d) An initial decision directing the issuance of a construction authorization or license under Part 60 of this chapter (relating to disposal of high-level radioactive wastes in geologic repositories) or any amendment to such an authorization or a license authorizing actions which may significantly affect the health and safety of the public. shall become effective only upon order of the Commission. The Director of Nuclear Material Safety and Safeguards shall not issue a construction authorization or a license under Part 60 of this chapter. or any amendment to such an authorization or license which may significantly affect the health and safety of the public until expressly authorized to do so by the Commission.

8. Section 2.780 is amended by adding a new paragraph (g) to read as follows:

§ 2.780 Ex parte communications.

* * * * *

(g) In the case of an application of for a license under Part 60 of this chapter (relating to disposal of high-level radioactive wastes in geologic repositories). this Part requires a proceeding on the record prior to the issuance of a construction authorization. Unless the Commission orders otherwise. the issuance of a construction authorization (or a final decision to deny a construction authorization) shall be deemed. for purposes of this section. to terminate all proceedings on the record then pending before the NRC with respect to such application.

PART 19—NOTICES, INSTRUCTIONS AND REPORTS TO WORKERS; INSPECTIONS

9. Section 19.2 is amended by adding "60." following "35. 40." to read as follows:

§ 19.2 Scope.

The regulations in this part apply to all persons who receive. possess. use. or transfer material licensed by the Nuclear Regulatory Commission pursuant to the regulations in Parts 30 through 35. 40. 60. or 70 of this chapter. including persons licensed to operate a production or utilization facility pursuant to Part 50 of this chapter.

10. Section 19.3(d) is amended by adding "60." following "35. 40." to read as follows:

§ 19.3 Definitions.

As used in this part:

* * * * *

(d) "License" means a license issued under the regulations in Parts 30 through 35. 40. 60 or 70 of this chapter. including licenses to operate a production or utilization facility pursuant to Part 50 of this chapter. "Licensee" means the holder of such a license.

PART 20—STANDARDS FOR PROTECTION AGAINST RADIATION

11. Section 20.2 is amended by adding "60." following "35. 40." to read as follows:

§ 20.2 Scope.

The regulations in this part apply to all persons who receive. possess. use. or transfer material licensed pursuant to the regulations in Parts 30 through 35. 40. 60 or 70 of this chapter. including persons licensed to operate a production or utilization facility pursuant to Part 50 of this chapter.

12. Section 20.3(a)(9) is amended by adding "60." following "30. 40." to read as follows:

§ 20.3 Definitions.

(a) As used in this part:

* * * * *

(9) "License" means a license issued under the regulations in Part 30. 40. 60 or 70 of this chapter. "Licensee" means the holder of such license.

§ 20.301 General requirement.

13. Section 20.301(a) is amended by adding "60." following "30. 40." to read as follows:

No licensee shall dispose of licensed material except:

(a) By transfer to an authorized recipient as provided in the regulations in Part 30. 40. 60. or 70 of this chapter. whichever may be applicable: or

* * * * *

14. Section 20.408 is amended by deleting the word "or" following the phrase "of this chapter:" in paragraph (a)(3). redesignating paragraph (4). including the table and accompanying note 1. as paragraph (5) and adding a new paragraph (4). Amended paragraph (a)(3) and new paragraph (a)(4) read as follows:

§ 20.408 Reports of personnel monitoring on termination of employment or work.

(a) * * *

(3) Possess or use at any one time. for purposes of fuel processing. fabricating. or reprocessing. special nuclear material in a quantity exceeding 5.000 grams of contained uranium-235. uranium-233. or plutonium or any combination thereof pursuant to Part 70 of this chapter:

(4) Possess high-level radioactive waste at a geologic repository operations area pursuant to Part 60 of this chapter: or

* * * * *

PART 21—REPORTING OF DEFECTS AND NONCOMPLIANCE

15. Section 21.2 is amended by inserting "60." after "35. 40." and also by inserting "60." after "40. 50." to read as follows:

§ 21.2 Scope.

The regulations in this part apply except as specifically provided otherwise in Parts 31. 34. 35. 40. 60 or 70 of this chapter. to each individual. partnership. corporation. or other entity licensed pursuant to the regulations in this chapter to possess. use. and/or transfer within the United States source. byproduct and/or special nuclear materials. or to construct. manufacture. possess. own. operate and/or transfer within the United States. any production or utilization facility. and to each director (see § 21.3(f)) ~~and~~ responsible officer (see § 21.3(j)) of such a licensee. The regulations in this part apply also to each individual. corporation. partnership or other entity doing business within the United States. and each director and responsible officer of such organization. that constructs (see § 21.3(c)) a production or utilization facility licensed for manufacture. construction or operation (see § 21.3(h)) pursuant to Part 50 of this chapter or supplies (see § 21.3(l)) basic component (see § 21.3(a)) for a facility or activity licensed. other than for export. under Parts 30. 40. 50. 60. 70. or 71.

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[6] The [illegible] [illegible] of § 2.764 (a) and (b) in [illegible] [illegible] and [illegible] [illegible] is [illegible] in [illegible] B to this part.

§ 21.3 Definitions. [Amended]

16. Section 21.3 is amended by adding the number "60" after "40. 50." wherever it appears in paragraphs (a). (a-1). and (k).

§ 21.21 Notification of failure to comply or existence of a defect.

17. Section 21.21(b)(1) is amended by adding the number "60" after "40. 50" wherever it appears in § 21.21(b)(1)(i) and (ii).

PART 30—RULES OF GENERAL APPLICABILITY TO LICENSING OF BYPRODUCT MATERIAL

18. Section 30.11 is amended by adding a new paragraph (c).

§ 30.11 Specific exemptions.

* * * * *

(c) The DOE is exempt from the requirements of this part to the extent that its activities are subject to the requirements of Part 60 of this chapter.

PART 40—DOMESTIC LICENSING OF SOURCE MATERIAL

19. Section 40.14 is amended by adding a new paragraph (c).

§ 40.14 Specific exemptions.

* * * * *

(c) The DOE is exempt from the requirements of this part to the extent that its activities are subject to the requirements of Part 60 of this chapter.

PART 51—LICENSING AND REGULATORY POLICY AND PROCEDURES FOR ENVIRONMENTAL PROTECTION

20. Section 51.5(a) is amended by redesignating paragraph (11) as paragraph (12) and adding a new paragraph (11) to read as follows:

§ 51.5 Actions requiring preparation of environmental impact statements, negative declarations, environmental impact appraisals; actions excluded.

(a) * * *

(11) Issuance of a construction authorization for a geologic repository operations area pursuant to Part 60 of this chapter.

* * * * *

21. Section 51.5(b)(4) is amended by changing the periods at the end of (b)(4)(iii) and (b)(4)(iv) to semicolons and adding the word "and" after the new semicolon at the end of paragraph (b)(iv). adding a new paragraph (v): substituting subparagraph (v) for subparagraph (iv) in paragraph (5): inserting "60" following "40." and "50." in paragraph (6): and adding new paragraphs (10) and (11). New paragraphs (b)(4)(v) and (10) and (11) read as follows:

(b) * * *

(4) * * *

(v) The receipt and possession of high-level radioactive waste at a geologic repository operations area pursuant to Part 60 of this chapter.

* * * * *

(10) Termination of a license for the possession of high-level radioactive waste at a geologic repository operations area at the request of the licensee.

(11) Issuance of a license to receive and possess high-level radioactive waste at a geologic repository operations area pursuant to Part 60 of this chapter.

22. Section 51.5(d)(3) is amended by adding "60." following "40. 50." to read as follows:

* * * * *

(d) * * *

(3) Non-substantive and insignificant amendments (from the standpoint of environmental impact) of Parts 20. 30. 40. 50. 60. 70. 71. 73. 100. or 110 of this chapter; and

* * * * *

23. Section 51.40 is amended by revising paragraph (a) and by adding a new paragraph (d) to read as follows:

§ 51.40 Environmental reports.

(a) Except as provided in paragraphs (b). (c) and (d) of this section. applicants for permits. licenses. and orders. and amendments thereto and renewals thereof. covered by § 51.5(a) shall submit to the Director of Nuclear Reactor Regulation or Director of Nuclear Material Safety and Safeguards. as appropriate. 150 copies of an environmental report which discusses the matters described in § 51.20. Petitioners for rule making covered by § 51.5(a) shall submit to the Director of Standards Development fifty (50) copies of an environmental report which discusses the matters described in § 51.20.

* * * * *

(d) The DOE. as an applicant for a license to receive and possess radioactive waste at a geologic repository operations area pursuant to Part 60 of this chapter. shall submit at the time of its application or in advance. and at the time of amendments. in the manner provided in § 60.22 of this chapter. environmental reports which discuss the matters described in § 51.20. The discussion of alternatives shall include site characterization data for a number of sites in appropriate geologic media so as to aid the Commission in making a comparative evaluation as a basis for arriving at a reasoned decision under NEPA. Such characterization data shall include results of appropriate in situ testing at repository depth unless the Commission finds with respect to a particular site that such testing is not required. The Commission considers the characterization of three sites representing two geologic media at least one of which is not salt to be the minimum necessary to satisfy the requirements of NEPA. (However. in light of the significance of the decision selecting a site for a repository. the Commission fully expects the DOE to submit a wider range of alternatives than the minimum required here.)

24. Section 51.41 is amended to read as follows:

§ 51.41 Administrative procedures.

Except as the context may otherwise require. procedures and measures similar to those described in §§ 51.22–51.28 will be followed in proceedings for the issuance of materials licenses and other actions covered by § 51.5(a) but not covered by § 51.20 or 51.21. The procedures followed with respect to materials licenses will reflect the fact that. unlike the licensing of production and utilization facilities. the licensing of materials does not require separate authorizations for construction and operation. In the case of an application for a license to receive and possess high-level radioactive waste at a geologic repository operations area pursuant to Part 60 of this chapter. however. the environmental impact statement required by § 51.5(a) shall be prepared and circulated prior to the issuance of a construction authorization: the environmental impact statement shall be supplemented prior to issuance of a license to take account of any substantial changes in the activities proposed to be carried out or significant new information regarding the environmental impacts of the proposed activities.

25. A new Part 60 is added to read as follows:

PART 60—DISPOSAL OF HIGH LEVEL RADIOACTIVE WASTES IN GEOLOGIC REPOSITORIES

Subpart A—General Provisions

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60.1 Purpose and scope.
60.2 Definitions.
60.3 License required.
60.4 Communications.
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60.21 Content of application.
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License Issuance and Amendment

60.41 Standards for issuance of a license.
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60.51 License amendment to decommission.
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Subpart C—Participation by State Governments and Indian Tribes

60.61 Site review.
60.62 Filing of proposals for State participation.
60.63 Approval of proposals.
60.64 Participation by Indian tribes.
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Subpart D—Records, Reports, Tests, and Inspections

60.71 Records and reports.
60.72 Tests.
60.73 Inspections.

Authority: Secs. 51. 53. 62. 63. 65. 81. 161b., f., i., o., p., 182. 183. Pub. L. 83–703. as amended. 68 Stat. 929. 930. 932. 933. 935. 948. 953. 954. as amended (42 U.S.C. 2071. 2073. 2092. 2093. 2095. 2111. 2201. 2232. 2233): Secs. 202. 206. Pub. L. 93–438. 88 Stat. 1244. 1246 (42 U.S.C. 5842. 5846): Sec. 14. Pub. L. 95–601 (42 U.S.C. 2021a): Sec 102(2)(c). Pub. L. 91–190. 83 Stat. 853 (42 U.S.C. 4332).

For the purposes of Sec. 223. 68 Stat. 958. as amended. 42 U.S.C. 2273. §§ 60.71 to 60.73 are issued under Sec. 161o.. 68 Stat. 950. as amended (42 U.S.C. 2201(o)).

Subpart A—General Provisions

§ 60.1 Purpose and scope.

This part prescribes rules governing the licensing of the U.S. Department of Energy to receive and possess source. special nuclear. and byproduct material at a geologic repository operations area. This part does not apply to any activity licensed under another part of this chapter.

§ 60.2 Definitions.

As used in this part:

(a) "Candidate area" means a geologic and hydrologic system within which a geologic repository may be located.

(b) "Commencement of construction" means clearing of land. surface or subsurface excavation. or other substantial action that would adversely affect the environment of a site. but does not include changes desirable for the temporary use of the land for public recreational uses. site characterization activities. other preconstruction monitoring and investigation necessary to establish background information related to the suitability of a site or to the protection of environmental values. or procurement or manufacture of components of the geologic repository operations area.

(c) "Commission" means the Nuclear Regulatory Commission or its duly authorized representatives.

(d) "DOE" means the U.S. Department of Energy or its duly authorized representatives.

(e) "Decommissioning". or "permanent closure". means final backfilling of subsurface facilities. sealing of shafts. and decontamination and dismantlement of surface facilities.

(f) "Disposal" means the isolation of radioactive wastes frm the biosphere.

(g) "Director" means the Director of the Nuclear Regulatory Commission's Office of Nuclear Material Safety and Safeguards.

(h) "Geologic repository" means a system which is intended to be used for. or may be used for. the disposal of radioactive wastes in excavated geologic formations. A geologic repository includes (1) the geologic repository operations area and (2) all surface and subsurface areas where natural events or activities of man may change the extent to which radioactive waste are effectively isolated from the biosphere.

(i) "Geologic repository operations area" means an HLW facility that is part of a geologic repository. including both surface and subsurface areas. where waste handling activities are conducted.

(j) "High-level radioactive waste" or "HLW" means (1) irradiated reactor fuel. (2) liquid wastes resulting from the operation of the first cycle solvent extraction system. or equivalent. and the concentrated wastes from subsequent extraction cycles. or equivalent. in a facility for reprocessing irradiated reactor fuel. and (3) solids into which such liquid wastes have been converted.

(k) "HLW facility" means a facility subject to the licensing and related regulatory authority of the Commission pursuant to Sections 202(3) and 202(4) of the Energy Reorganization Act of 1974 (88 Stat 1244).[5]

(l) "Indian Tribe" means an Indian tribe as defined in the Indian Self-Determination and Education Assistance Act (Public Law (93–638).

(m) "Important to safety," with reference to structures. systems. and components. means those structures. systems. and components that provide reasonable assurance that radioactive waste can be received. handled. and stored without undue risk to the health and safety of the public.

(n) "Public Document Room" means the place at 1717 H Street NW.. Washington. D.C.. at which records of the Commission will ordinarily be made available for public inspection and any other place. the location of which has been published in the **Federal Register**. at which public records of the Commission pertaining to a particular geologic repository are made available for public inspection.

(o) "Radioactive waste" means HLW and any other radioactive materials other than HLW that are received for emplacement in a geologic repository.

(p) "Site characterization" means the program of exploration and research. both in the laboratory and in the field. undertaken to establish the geologic conditions and the ranges of those parameters of a particular site relevant to the procedures under this part. Site characterization includes borings. surface excavations. excavation of exploratory shafts. limited subsurface lateral excavations and borings, and in situ testing at depth needed to determine the suitability of the site for a geologic repository, but does not include preliminary borings and geophysical testing needed to decide whether site characterization should be undertaken.

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[5] These are DOE "facilities used primarily for the receipt and storage of high-level radioactive wastes resulting from activities licensed under such act [the Atomic Energy Act]" and "Retrievable Surface Storage Facilities and other facilities authorized for the express purpose of subsequent long-term storage of high-level radioactive wastes generated by [DOE], which are not used for, or are part of, research and development activities."

(q) "Tribal organization" means a Tribal organization as defined in the Indian Self-Determination and Education Assistance Act (Public Law 93–638).

§ 60.3 License required.

(a) DOE shall not receive or possess source, special nuclear, or byproduct material at a geologic repository operations area except as authorized by a license issued by the Commission pursuant to this part.

(b) DOE shall not commence construction of a geologic repository operations area unless it has filed an application with the Commission and has obtained construction authorization as provided in this part. Failure to comply with this requirement shall be grounds for denial of a license.

§ 60.4 Communications.

Except where otherwise specified, all communications and reports concerning the regulations in this part and applications filed under them should be addressed to the Director of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555. Communications, reports, and applications may be delivered in person at the Commission's offices at 1717 H Street NW, Washington, D.C., or 7915 Eastern Avenue, Silver Spring, Maryland.

§ 60.5 Interpretations.

Except as specifically authorized by the Commission, in writing, no interpretation of the meaning of the regulations in this part by any officer or employee of the Commission other than a written interpretation by the General Counsel will be considered binding upon the Commission.

§ 60.6 Exemptions.

The Commission may, upon application by DOE, any interested person, or upon its own initiative, grant such exemptions from the requirements of the regulations in this part as it determines are authorized by law, will not endanger life or property or the common defense and security, and are otherwise in the public interest.

§ 60.7 License not required for certain preliminary activities.

The requirement for a license set forth in § 60.3(a) of this part is not applicable to the extent that DOE receives and possesses source, special nuclear, and byproduct material at a geologic repository:

(a) For purposes of site characterization; or

(b) For use, during site characterization or construction, as components of radiographic, radiation monitoring, or similar equipment or instrumentation.

Subpart B—Licenses

Preapplication Review

§ 60.10 Site characterization.

(a) Prior to submittal of an application for a license to be issued under this part the DOE shall conduct a program of site characterization with respect to the site to be described in such application.

(b) Unless the Commission determines with respect to the site described in the application that it is not necessary, site characterization shall include a program of in situ exploration and testing at the depths that wastes would be emplaced.

(c) As provided in § 51.40 of this chapter, DOE is also required to conduct a program of site characterization, including in situ testing at depth, with respect to alternative sites.

§ 60.11 Site characterization report.

(a) As early as possible after commencement of planning for a particular geologic repository operations area, and prior to site characterization, the DOE shall submit to the Director a Site Characterization Report. The report shall include[*] (1) a description of the site to be characterized; (2) the criteria used to arrive at the candidate area; (3) the method by which the site was selected for site characterization; (4) identification and location of alternative media and sites at which DOE intends to conduct site characterization and for which DOE anticipates submitting subsequent Site Characterization Reports; (5) a description of the decision process by which the site was selected for characterization, including the means used to obtain public, Indian tribal and State views during selection; (6) a description of the site characterization program including (i) the extent of planned excavation and plans for in situ testing, (ii) a conceptual design of a repository appropriate to the named site in sufficient detail to allow assessment of the site characterization program with respect to investigation activities which address the ability of the site to host a repository and isolate radioactive waste, or which may affect such ability, and (iii) provisions to control any adverse, safety-related effects from site characterization, including appropriate quality assurance programs; (7) a description of the quality assurance program to be applied to data collection; and (8) any issues related to the site selection, alternative candidate areas or sites, or design of the geologic repository operations area which the DOE wishes the Commission to review. Also included shall be a description of the research and development activities being conducted by DOE which deal with the waste form and packaging which may be considered appropriate for the site to be characterized, including research planned or underway to evaluate the performance of such waste forms and packaging.

(b) The Director shall cause to be published in the **Federal Register** a notice that the information submitted under paragraph (a) of this section has been received and that a staff review of that information has begun. The notice shall identify the site selected for site characterization and alternate areas being considered by DOE and shall advise that consultation may be requested by State and local governments and Tribal organizations in accordance with Subpart C of this part.

(c) The Director shall make available a copy of the above information at the Public Document Room. The Director also shall transmit copies and the published notice of receipt thereof to the Governor and legislature of the State and to the chief executive of the municipality in which a site to be characterized is located (or if it is not located within a municipality, then to the chief executive of the county, or to the Tribal organization if it is to be located within an Indian reservation) and to the Governors of any contiguous States.

(d) The Director shall prepare a draft site characterization analysis which shall discuss the items cited in paragraph (a) of this section. The Director shall publish a notice of availability of the draft site characterization analysis and a request for comment in the **Federal Register**. Copies shall be made available at the Public Document Room. The Director shall also transmit copies to the Governor and legislature of the State and the chief executive of the municipality in which a site to be characterized is located (or if it is not located within a municipality, then to the chief executive of the county, or to the Tribal organization if it is to be located within an Indian reservation) and to the Governors of any contiguous States.

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[*] To the extent that the information indicated in items 2 through 5 appears in an Environmental Impact Statement prepared by DOE for site characterization at the named site, it may be incorporated into DOE's Site Characterization Report by reference.

(e) A reasonable period. not less than 90 days. shall be allowed for comment on the draft site characterization analysis. The Director shall then prepare a final site characterization analysis which shall take into account comments received and any additional information acquired during the comment period. Included in the final site characterization analysis shall be either an opinion by the Director that he has no objection to the DOE's site characterization program. if such an opinion is appropriate. or specific objections of the Director to DOE's proceeding with characterization of the named site. In addition. the Director may make specific recommendations to DOE on the matters pertinent to this section. A copy of the final site characterization analysis and the Director's opinion will be transmitted to DOE.

(f) Neither issuance of a final site characterization analysis nor the opinion by the Director shall constitute a commitment to issue any authorization or license or in any way affect the authority of the Commission. the Atomic Safety and Licensing Appeal Board. Atomic Safety and Licensing Boards. other presiding officers. or the Director. in any proceeding under Subpart G of Part 2 of this chapter. If DOE prepares an Environmental Impact Statement with respect to site characterization activities proposed for a particular site. it should consider NRC's site characterization analyses before publishing its final Environmental Impact Statement with respect to site characterization activities proposed for that particular site.

(g) During site characterization. DOE shall inform the Director by semiannual report and by other reports on any topic related to site characterization if requested by the Director. of the progress of the site characterization and waste form and packaging research and development. The semiannual reports should include the results of site characterization studies. the identification of new issues. plans for additional studies to resolve new issues. elimination of planned studies no longer necessary. identification of decision points reached and modification to schedules were appropriate. Also reported should be the DOE's progress in developing the design of a geologic repository operations area appropriate for the site being characterized. noting when key design parameters or features which depend upon the results of site characterization will be established. During this time. NRC staff shall be permitted to visit and inspect the site and observe excavations. borings. and in situ tests as they are done.

(h) The Director may comment at any time in writing to DOE. expressing current views on any aspect of site characterization. Comments received from States in accordance with § 60.61 shall be considered by the Director in formulating his views. All correspondence between DOE and the NCR including the reports cited in paragraph (g) shall be placed in the Public Document Room.

(i) The activities described in paragraphs (a) through (h) above constitute informal conference between a prospective applicant and the staff. as described in § 2.101(a)(1) of this chapter. and are not part of a proceeding under the Atomic Energy Act of 1954. as amended.

License Applications

§ 60.21 Content of application.

(a) An application shall consist of general information and a Safety Analysis Report. An environmental report shall be prepared in accordance with Part 51 of this chapter and shall accompany the application. Any Restricted Data or National Security Information shall be separated from unclassified information.

(b) The general information shall include:

(1) A general description of the proposed geologic repository identifying the location of the geologic repository operations area. the general character of the proposed activities. and the basis for the exercise of licensing authority by the Commission.

(2) Proposed schedules for construction. receipt of waste. and emplacement of wastes at the proposed geologic repository operations area.

(3) A certification that DOE will provide at the geologic repository operations area such safeguards as it requires at comparable surface facilities (of DOE) to promote the common defense and security.

(4) A description of the physical security plan for protection against radiological sabotage. Since the radiation hazards associated with high-level wastes make them inherently unattractive as a target for theft or diversion. no detailed information need be submitted on protection against theft or diversion.

(5) A description of site characterization work actually conducted by DOE at all sites considered in the application and. as appropriate. explanations of why such work differed from the description of the site characterization program described in the Site Characterization Report for each site.

(c) The Safety Analysis Report shall include:

(1) A description and analysis of the site at which the proposed geologic repository operations area is to be located with appropriate attention to those features that might affect facility design and performance. The assessment shall contain an analysis of the geology. geophysics. hydrology. geochemistry. and meteorology of the site and the major design structures. systems. and components. both surface and sub-surface. that bear significantly on the suitablity of the geologic repository for disposal of radioactive waste. It will be assumed that operations at the geologic repository operations area will be carried out at the maximum capacity and rate of receipt of radioactive waste stated in the application.

(2) A description and discussion of the design. both surface and subsurface. of the geologic repository operations area including: (i) the principal design criteria and their relationship to any general performance objectives promulgated by the Commission. (ii) the design bases and the relation of the design bases to the principal design criteria. (iii) information relative to materials of construction (including geologic media. general arrangement. and approximate dimensions). and (iv) codes and standards that DOE proposes to apply to the design and construction of the geologic repository operations area.

(3) A description and analysis of the design and performance requirements for structures. systems. and components of the geologic repository which are important to safety. The analysis and evaluation shall consider (i) the margins of safety under normal conditions and under conditions that may result from anticipated operational occurrences. including those of natural origin: (ii) the adequacy of structures. systems. and components provided for the prevention of accidents and mitigation of the consequences of accidents. including those caused by natural phenomena: and (iii) the effectiveness of engineered and natural barriers. including barriers that may not be themselves a part of the geologic repository operations area. against the release of radioactive material to the environment.

(4) A description of the quality assurance program to be applied to the design. fabrication. inspection. construction. testing. and operation of

the structures. systems. and components of the geologic repository operations area important to safety.[7]

(5) A description of the kind. amount. and specifications of the radioactive material proposed to be received and possessed at the geologic repository operations area.

(6) An identification and justification for the selection of those variables. conditions. or other items which are determined to be probable subjects of license specifications. Special attention shall be given to those items that may significantly influence the final design.

(7) A description of the program for control and monitoring of radioactive effluents and occupational radiation exposures to maintain such effluents and exposures in accordance with the requirements of Part 20 of this chapter.

(8) A description of the controls that the applicant will apply to restrict access and to regulate land use at the geologic repository operations area and adjacent areas.

(9) Plans for coping with radiological emergencies at any time prior to completion of decommissioning the geologic repository operations area.

(10) A description of the nuclear material control and accounting program.

(11) A description of design considerations that are intended to facilitate decommissioning of the facility.

(12) A description of plans for retrieval and alternate storage of the radioactive wastes should the geologic repository prove to be unsuitable for disposal of radioactive wastes.

(13) An identification of the natural resources at the site. the exploitation of which could affect the ability of the site to isolate radioactive wastes.

(14) An identification of those structures. systems. and components of the geologic repository. both surface and subsurface. which require research and development to confirm the adequacy of design. For systems. structures. and components important to safety. the DOE shall provide a detailed description of the programs designed to resolve safety questions. including a schedule indicating when these questions will be resolved.

(15) The following information concerning activities at the geologic repository operations area:

(i) The organizational structure of DOE. offsite and onsite. including a description of any delegations of authority and assignments of responsibilities. whether in the form of regulations. administrative directives. contract provisions. or otherwise.

(ii) The quality assurance program to be used to ensure safety.

(iii) Identification of key positions which are assigned responsibility for safety at and operation of the geologic repository operations area.

(iv) Personnel qualifications and training requirements.

(v) Plans for startup activities and startup testing.

(vi) Plans for conduct of normal activities. including maintenance. surveillance. and periodic testing of structures. systems. and components of the geologic repository operations area.

(vii) Plans for decommissioning.

(viii) Plans for any uses of the geologic repository operations area for purposes other than disposal of radioactive wastes. with an analysis of the effects. if any. that such uses may have upon the operation of the structures. systems. and components important to safety.

§ 60.22 Filing and distribution of application.

(a) An application for a license to receive and possess source. special nuclear. or byproduct material in a geologic repository at a site which has been characterized. and an accompanying environmental report. and any amendments thereto. shall be filed in triplicate with the Director and shall be signed by the Secretary of Energy or his authorized representative.

(b) Each portion of such application and environmental report and any amendments shall be accompanied by 30 additional copies. Another 120 copies shall be retained by DOE for distribution in accordance with written instructions from the Director or the Director's designee.

(c) DOE shall. upon notification of the appointment of an Atomic Safety and Licensing Board. update the application and environmental report. eliminating all superseded information. and serve them as directed by the Board. In addition. at that time DOE shall serve one such copy on the Atomic Safety and Licensing Appeal Panel. Any subsequent amendments to the application or environmental report shall be served in the same manner.

(d) At the time of filing of an application and environmental report. and any amendments thereto. one copy shall be made available in an appropriate location near the site of the proposed geologic repository (which shall be a public document room. if one has been established) for inspection by the public and updated as amendments to the application or environmental report are made. An updated copy shall be produced at any public hearing on the application for use by any parties to the proceeding.

(e) The DOE shall certify that the updated copies of the application and environmental report. as referred to in paragraphs (c) and (d). contain the current contents of such documents submitted in accordance with the requirements of this part.

§ 60.23 Elimination of repetition.

In its application. environmental report. or Site Characterization Report. the DOE may incorporate by reference information contained in previous applications. statements. or reports filed with the Commission: PROVIDED. that such references are clear and specific and that copies of the information so incorporated are available in the public document room located near the site of the proposed geologic repository.

§ 60.24 Updating of application and environmental report.

(a) The application and environmental report shall be as complete as possible in the light of information that is reasonably available at the time of docketing.

(b) The DOE shall update its application in a timely manner so as to permit the Commission to review. prior to issuance of a license:

(1) Additional geologic. geophysical. geochemical. hydrologic. meteorologic and other data obtained during construction.

(2) Conformance of construction of structures. systems. and components with the design.

(3) Results of research programs carried out to confirm the adequacy of designs.

(4) Other information bearing on the Commission's issuance of a license that was not available at the time a construction authorization was issued.

(c) The DOE shall update its environmental report in a timely manner so as to permit the Commission to review. prior to issuance of a license. the environmental impacts of any substantial changes in the activities proposed to be carried out or any significant new information regarding the environmental impacts of activities previously proposed.

Construction Authorization

§ 60.31 Construction authorization.

Upon review and consideration of an application and environmental report submitted under this part. the Commission may authorize construction if it determines:

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[7] The criteria in Appendix B of Part 50 of this chapter will be used by the Commission in determining the adequacy of the quality assurance program.

(a) *Safety*. That there is reasonable assurance that the types and amounts of radioactive materials described in the application can be received. possessed. and disposed of in a repository of the design proposed without unreasonable risk to the health and safety of the public. In arriving at this determination. the Commission shall consider whether:

(1) The DOE has described the proposed geologic repository including but not limited to (i) the geologic. geophysical. geochemical and hydrologic characteristics of the site: (ii) the kinds and quantities of radioactive waste to be received. possessed. stored. and disposed of in the geologic repository: (iii) the principal architectural and engineering criteria for the design of the geologic repository operations area: (iv) construction procedures which may affect the capability of the geologic repository to serve its intended function: and (v) features or components incorporated in the design for the protection of the health and safety of the public.

(2) The site and design comply with the criteria contained in Subparts E and F of this part.

(3) The DOE's quality assurance program complies with the requirements of Subpart G of this part.

(4) The DOE's personnel training program complies with the criteria contained in Subpart H of this part.

(5) The DOE's emergency plan complies with the criteria contained in Subpart I of this part.

(6) The DOE's proposed operating procedures to protect health and to minimize danger to life or property are adequate.

(b) *Common defense and security*. That there is reasonable assurance that the activities proposed in the application will not be inimical to the common defense and security. A DOE certification that it will provide at the geologic repository operations area such safeguards as it requires at comparable DOE surface facilities to promote the common defense and security will constitute a rebuttable presumption of noninimicality to the common defense and security.

(c) *Environmental*. That. after weighing the environmental. economic. technical and other benefits against environmental costs and considering available alternatives. the action called for is issuance of the construction authorization. with any appropriate conditions to protect environmental values.

§ 60.32 Conditions of construction authorization.

(a) A construction authorization shall include such conditions as the Commission finds to be necessary to protect the health and safety of the public. the common defense and security. or environmental values.

(b) The Commission will incorporate in the construction authorization provisions requiring the DOE to furnish periodic or special reports regarding: (1) progress of construction. (2) any site data obtained during construction which are not within the predicted limits upon which the facility design was based. (3) any deficiencies in design and construction which. if uncorrected. could adversely affect safety at any future time. and (4) results of research and development programs being conducted to resolve safety questions.

(c) The construction authorization will include restrictions on subsequent changes to the features of the respository and the procedures authorized. These restrictions will fall into three categories of descending importance to public health and safety as follows: (1) those features and procedures which may not be changed without (i) 60 days prior notice to the Commission. (ii) 30 days notice of opportunity for a prior hearing. and (iii) prior Commission approval: (2) those features and procedures which may not be changed without (i) 60 days prior notice to the Commission. and (ii) prior Commission approval: and (3) those features and procedures which may not be changed without 60 days prior notice to the Commission. Features and procedures falling in paragraph (c)(3) of this section may not be changed without prior Commission approval if the Commission. after having received the required notice. so orders.

(d) A construction authorization shall be subject to the limitation that a license to receive and possess source. special nuclear. or byproduct material at the geologic repository operations area shall not be issued by the Commission until (1) the DOE has updated its application as specified in § 60.24. and (2) the Commission has made the findings stated in § 60.41.

§ 60.33 Amendment of construction authorization.

(a) An application for amendment of a construction authorization shall be filed with the Commission fully describing any changes desired and following as far as applicable the format prescribed in § 60.21.

(b) In determining whether an amendment of a construction authorization will be approved. the Commission will be guided by the considerations which govern the issuance of the initial construction authorization. to the extent applicable.

License Issuance and Amendment

§ 60.41 Standards for issuance of a license.

A license to receive and possess source. special nuclear. or byproduct material at a geologic repository operations area may be issued by the Commission upon finding that:

(a) Construction of the geologic repository operations area has been substantially completed in conformity with the application as amended. the provisions of the Atomic Energy Act. and the rules and regulations of the Commission. Construction may be deemed to be substantially complete for the purposes of this paragraph if the construction of (1) surface and interconnecting structures, systems. and components. and (2) any underground storage space required for initial operation are substantially complete.

(b) The activities to be conducted at the geologic repository operations area will be in conformity with the application as amended. the provisions of the Atomic Energy Act and the Energy Reorganization Act. and the rules and regulations of the Commission.

(c) The issuance of the license will not be inimical to the common defense and security and will not constitute an unreasonable risk to the health and safety of the public. A DOE certification that it will provide at the geologic repository operations area such safeguards as it requires at comparable DOE facilities to promote the common defense and security. will constitute a rebuttable presumption of non-inimicality to the common defense and security.

(d) All applicable requirements of Part 51 have been satisfied.

§ 60.42 Conditions of license.

(a) A license issued pursuant to this part shall include such conditions. including license specifications. as the Commission finds to be necessary to protect the health and safety of the public. the common defense and security. and environmental values.

(b) Whether stated therein or not. the following shall be deemed conditions in every license issued:

(1) The license shall be subject to revocation. suspension. modification. or amendment for cause as provided by the Atomic Energy Act and the Commission's regulations.

(2) The DOE shall at any time while the license is in effect. upon written request of the Commission. submit

written statements to enable the Commission to determine whether or not the license should be modified, suspended or revoked.

(3) The license shall be subject to the provisions of the Atomic Energy Act now or hereafter in effect and to all rules, regulations, and orders of the Commission. The terms and conditions of the license shall be subject to amendment, revision, or modification, by reason of amendments to or by reason of rules, regulations, and orders issued in accordance with the terms of the Atomic Energy Act.

(c) Each license shall be deemed to contain the provisions set forth in Section 183 b-d, inclusive, of the Atomic Energy Act, whether or not these provisions are expressly set forth in the license.

§ 60.43 License specifications.

(a) A license issued under this part shall include license conditions derived from the analyses and evaluations included in the application, including amendments made before a license is issued, together with such additional conditions as the Commission finds appropriate.

(b) License conditions shall include items in the following categories:

(1) Restrictions as to the physical and chemical form and radioisotopic content of radioactive waste.

(2) Restrictions as to size, shape, and materials and methods of construction of radioactive waste packaging.

(3) Restrictions as to the amount of waste permitted per unit volume of storage space considering the physical characteristics of both the waste and the storage medium.

(4) Requirements relating to test, calibration, or inspection to assure that the foregoing restrictions are observed.

(5) Controls to be applied to restrict access and to avoid disturbance to the geologic repository operations area and adjacent areas.

(6) Administrative controls, which are the provisions relating to organization and management, procedures, recordkeeping, review and audit, and reporting necessary to assure that activities at the facility are conducted in a safe manner and in conformity with the other license specifications.

§ 60.44 Changes, tests, and experiments.

(a)(1) Following authorization to receive and possess source, special nuclear, or byproduct material at a geologic repository operations area, the DOE may (i) make changes in the geologic repository operations area as described in the application, (ii) make changes in the procedures as described in the application, and (iii) conduct tests or experiments not described in the application, without prior Commission approval, provided the change, test, or experiment involves neither a change in the license conditions incorporated in the license nor an unreviewed safety question.

(2) A proposed change, test, or experiment shall be deemed to involve an unreviewed safety question if (i) the likelihood of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the application is increased, (ii) the possibility of an accident or malfunction of a different type than any previously evaluated in the application is created, or (iii) the margin of safety as defined in the basis for any license condition is reduced.

(b) The DOE shall maintain records of changes in the geologic repository operations area and of changes in procedures made pursuant to this section, to the extent that such changes constitute changes in the geologic repository operations area or procedures as described in the application. Records of tests and experiments carried out pursuant to paragraph (a) of this section shall also be maintained. These records shall include a written safety evaluation which provides the basis for the determination that the change, test, or experiment does not involve an unreviewed safety question. The DOE shall prepare annually, or at such shorter intervals as may be specified in the license, a report containing a brief description of such changes, tests, and experiments, including a summary of the safety evaluation of each. The DOE shall furnish the report to the appropriate NRC Regional Office shown in Appendix D of Part 20 of this chapter with a copy to the Director of Inspection and Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555. Any report submitted pursuant to this paragraph shall be made a part of the public record of the licensing proceedings.

§ 60.45 Amendment of license.

(a) An application for amendment of a license may be filed with the Commission fully describing the changes desired and following as far as applicable the format prescribed for license applications.

(b) In determining whether an amendment of a license will be approved, the Commission will be guided by the considerations that govern the issuance of the initial license, to the extent applicable.

§ 60.46 Particular activities requiring license amendment.

(a) Unless expressly authorized in the license, an amendment of the license shall be required with respect to any of the following activities:

(1) Any action which would make emplaced high-level radioactive waste irretrievable or which would substantially increase the difficulty of retrieving such emplaced waste.

(2) Dismantling of structures.

(3) Removal or reduction of controls applied to restrict access to or to avoid disturbance of the geologic repository operations area or adjacent areas.

(4) Destruction or disposal of records required to be maintained under the provisions of this part.

(5) Any substantial change to the design or operating procedures from that specified in the license.

(6) Decommissioning.

(b) An application for such an amendment shall be filed, and shall be reviewed, in accordance with the provisions of § 60.45.

Decommissioning

§ 60.51 License amendment to decommission.

(a) The DOE shall submit an application to amend the license prior to decommissioning. The application shall consist of an update of the license application and environmental report submitted under §§ 60.21 and 60.22, including:

(1) A description of the program for post-decommissioning monitoring of the geologic repository.

(2) A detailed description of the measures to be employed—such as land use controls, construction of monuments, and preservation of records—to regulate or prevent activities that could impair the long-term isolation of emplaced waste within the geologic repository and to assure that relevant information will be preserved for the use of future generations.

(3) Geologic, geophysical, geochemical, hydrologic, and other site data that are obtained during the operational period pertinent to the long-term isolation of emplaced radioactive wastes.

(4) The results of tests, experiments, and any other analyses relating to backfill of excavated areas, shaft sealing, waste interaction with emplacement media, and any other tests, experiments, or analyses pertinent to the long-term isolation of emplaced wastes within the geologic repository.

(5) Any substantial revision of plans for decommissioning.

(6) Other information bearing upon decommission that was not available at the time a license was issued.

(b) The DOE shall update its environmental report in a timely manner so as to permit the Commission to review, prior to issuance of an amendment, substantial changes in the decommissioning activities proposed to be carried out or significant new information regarding the environment impacts of such decommissioning.

§ 60.52 Termination of license.

(a) Following decommissioning, the DOE may apply for an amendment to terminate the license.

(b) Such application shall be filed, and will be reviewed, in accordance with the provisions of § 60.45 and this section.

(c) A license shall be terminated only when the Commission finds with respect to the geologic repository:

(1) That the final disposition of radioactive wastes has been made in conformance with the DOE's plan, as amended and approved as part of the license.

(2) That the final state of the geologic repository operations area site conforms to the DOE's decommissioning plans, as amended and approved as part of the license.

(3) That the termination of the license is authorized by law, including Sections 57, 62, and 81 of the Atomic Energy Act, as amended.

Subpart C—Participation by State Governments and Indian Tribes

§ 60.61 Site review.

(a) Upon publication in the **Federal Register** of a notice that the DOE has selected a site for site characterization, in accordance with § 60.11(b), and upon the request of a State, the Director shall make available NRC staff to consult with representatives of State, Indian tribal and local governments to keep them informed of the Director's view on the progress of site characterization and to notify them of any subsequent meetings or further consultations with the DOE.

(b) Requests for consultation shall be made in writing to the Director.

(c) The Director also shall respond to written questions or comments from the State, Indian tribal and local governments as appropriate, on the information submitted by the DOE in accordance with § 60.11 of this part. Copies of such questions or comments and their responses shall be made available in the Public Document Room and shall be transmitted to the DOE.

§ 60.62 Filing of proposals for State participation.

(a) Consultation under § 60.61 may include, among other things, a review of applicable NRC regulations, licensing procedures, potential schedules, and the type and scope of State activities in the license review permitted by law. In addition, staff shall be made available to cooperate with the State in developing proposals for participation by the State.

(b) States potentially affected by siting of a geologic repository operations area at a site that has been selected for characterization may submit to the Director a proposal for State participation in the review of the Site Characterization Report and/or license application. A State's proposal to participate may be submitted at any time prior to docketing of an application or up to 120 days thereafter.

(c) Proposals for participation in the review shall be signed by the Governor of the State submitting the proposal and shall at a minimum contain the following information:

(1) A general description of how the State wishes to participate in the review, specifically identifying those issues which it wishes to review.

(2) A description of material and information which the State plans to submit to the NRC staff for consideration in the review. A tentative schedule referencing steps in the review and calendar dates for planned submittals should be included.

(3) A description including funding estimates of any work that the State proposes to perform for the Commission, under contract, in support of the review.

(4) A description of State plans to facilitate local government and citizen participation.

(5) A preliminary estimate of the types and extent of impacts which the State expects should a geologic repository be located at the site in question.

(d) If the State desires educational or information services (seminars, public meetings) or other actions on the part of NRC, such as establishing additional public document rooms or employment or exchange of State personnel under the Intergovernmental Personnel Act, these shall be included with the proposal.

§ 60.63 Approval of proposals.

(a) The Director shall arrange for a meeting between the representatives of the State and the NRC staff to discuss any proposal submitted under § 60.62(b), with a view to identifying any modifications that may contribute to the effective participation by the State.

(b) Subject to the availability of funds, the Director shall approve all or any part of a proposal, as it may be modified through the meeting described above, if it is determined that:

(1) The proposed activities are suitable in light of the type and magnitude of impacts which the State may bear, and

(2) The proposed activities (i) will enhance communications between NRC and the State, (ii) will contribute productively to the license review, and (iii) are authorized by law.

(c) The decision of the Director shall be transmitted in writing to the Governor of the originating State. A copy of the decision shall be made available at the Public Document Room. If all or any part of a proposal is rejected, the decision shall state the reason for the rejection.

(d) A copy of all proposals received shall be made available at the Public Document Room.

§ 60.64 Participation by Indian tribes.

(a) Any Indian tribe which is potentially affected by siting of a geologic repository operations area at a site that has been selected for characterization may:

(1) Request consultation, as provided with respect to States under § 60.61.

(2) Submit proposals for participation, as provided with respect to States under § 60.62, except that such proposals shall be signed by the chief executive (or other specifically authorized representative) of the Tribal organization.

(b) The Director shall respond to such requests or proposals in the manner provided in this subpart, except that decisions under § 60.63 shall be transmitted in writing to the chief executive (or other specifically authorized representative) of the Tribal organization.

(c) Any request or proposal under this section shall be accompanied by such documentation as may be needed to determine the eligibility of the Indian tribe or the specific authority of its representatives.

§ 60.65 Coordination.

The Director may take into account the desirability of avoiding duplication of effort in taking action on multiple proposals submitted pursuant to the provisions of this Subpart to the extent this can be accomplished without substantial prejudice to the parties concerned.

Subpart D—Records, Reports, Tests, and Inspections

§ 60.71 Records and reports.

(a) The DOE shall maintain such records and make such reports in connection with the licensed activity as may be required by the conditions of the license or by rules, regulations, and orders of the Commission as authorized by the Atomic Energy Act and the Energy Reorganization Act.

(b) Records of the receipt, handling, and disposition of radioactive waste at a geologic repository operations area shall contain sufficient information to provide a complete history of the movement of the waste from the shipper through all phases of storage and disposal.

(c) The DOE shall promptly notify the Commission of each deficiency found in the site characteristics, and design and construction of the geologic repository operations area which, were it to remain uncorrected, could (1) be a substantial safety hazard, (2) represent a significant deviation from the design criteria and design bases stated in the application, or (3) represent a deviation from the conditions stated in the terms of a construction authorization or the license, including license specifications. The notification shall be in the form of a written report, copies of which shall be sent to the Director and to the appropriate Nuclear Regulatory Commission Inspection and Enforcement Regional Office listed in Appendix D of Part 20 of this chapter.

§ 60.72 Tests.

The DOE shall perform, or permit the Commission to perform, such tests as the Commission deems appropriate or necessary for the administration of the regulations in this part. These may include tests of (a) radioactive waste, (b) the geologic repository including its structures, systems, and components, (c) radiation detection and monitoring instruments, and (d) other equipment and devices used in connection with the receipt, handling, or storage of radioactive waste.

§ 60.73 Inspections.

(a) The DOE shall allow the Commission to inspect the premises of the geologic repository operations area and adjacent areas to which the DOE has rights of access.

(b) The DOE shall make available to the Commission for inspection, upon reasonable notice, records kept by the DOE pertaining to activities under this part.

(c)(1) The DOE shall upon request by the Director, Office of Inspection and Enforcement, provide rent-free office space for the exclusive use of the Commission inspection personnel. Heat, air conditioning, light/electrical outlets and janitorial services shall be furnished by DOE. The office shall be convenient to and have full access to the facility and shall provide the inspector both visual and acoustic privacy.

(2) The space provided shall be adequate to accommodate a full-time inspector, a part-time secretary and transient NRC personnel and will be generally commensurate with other office facilities at the site. A space of 250 square feet either within the site's office complex or in an office trailer or other onsite space is suggested as a guide. For sites containing multiple facilities, additional space may be requested to accommodate additional full time inspector(s). The office space that is provided shall be subject to the approval of the Director, Office of Inspection and Enforcement. All furniture, supplies and communication equipment will be furnished by the Commission.

(3) DOE shall afford any NRC resident inspector assigned to that site, or other NRC inspectors identified by the Regional Director as likely to inspect the facility, immediate unfettered access, eqivalent to access provided regular employees, following proper identification and compliance with applicable access control measures for security, radiological protection and personal safety.

PART 70—DOMESTIC LICENSING OF SPECIAL NUCLEAR MATERIAL

28. Section 70.14 is amended by adding a paragraph (c).

§ 70.14 Specific exemptions.

* * * * *

(c) The DOE is exempt from the requirements of the regulations in this part to the extent that its activities are subject to the requirements of Part 60 of the chapter.

(Amendments to all parts issued pursuant to citations of authority presently codified or, in the case of 10 CFR Part 60, as set out after the list of sections in new Part 60)

Dated at Washington, D.C. this 19th day of February, 1981.

For the U.S. Nuclear Regulatory Commission.

Samuel J. Chilk,

Secretary of the Commission.

[FR Doc. 81-[illegible] Filed 2-20-81; 8:45 am]

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ATTACHMENT C

MODIFICATIONS TO 10 CFR PART 60

10 CFR Part 60 - Disposal of High-Level Radioactive Wastes in Geologic Repositories

	ISSUE DATE
Licensing Procedures for HLW in Geologic Repositories	February 1981
-Revision to Conform to NWPA Requirements Concerning NRC-State/Tribe Interactions (Proposed Rule)	January 1985
-Revision to Conform to NWPA Requirements Concerning Adoption of DOE EIS (Proposed Rule)	*November 1985
Technical Criteria for HLW In Geologic Repositories	June 1983
-Revision to include HLW Definition (Advanced Notice of Proposed Rulemaking)	*June 1985
-Amednment to Conform to EPA Standards (Proposed Rule)	Following Issuance of EPA Standard
-Revision to include Unsaturated Zone (Final Rule)	*September 1985
-Amendment to Clarify Definition of Disturbed Zone (Proposed Rule)	*1987
-Amendments to Establish Compliance Demonstration Methods	As Need is Identified

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*Current Schedule

ATTACHMENT D

NRC LICENSING GUIDANCE

SITE CHARACTERIZATION ANALYSIS AND SEMI-ANNUAL REPORTS

The SCA's will be issued by NRC as A NUREG document as a result of the staff evaluations of the DOE's Site Characterization Plans (SCP's). An SCP is issued before an exploratory shaft is sunk at any candidate site. Follow up will be provided by semi-annual reports issued by the staff. The NRC reports would be in response to the DOE's semi-annual reports which are also required under the NWPA (Section 113).

TITLE	ISSUE DATE
BWIP Site Characterization Analysis--NUREG-0906	April 1983

B. REGULATORY GUIDES

Regulatory Guides are drafted by the staff to establish a standard approach to licensing. They are not directives, but reflect acceptable procedures or actions which would be considered acceptable by the staff.

The current plans are to issue standard content and format documents as Regulatory Guides.

TITLE	DESCRIPTION	ISSUE DATE
1. Regulatory Guide 4.17**	Standard Format and Content of Site Characterization Reports for High-Level Waste Geologic Repositories (Draft)	July 1982
2. Regulatory Guide ____	Safety Analysis Report Format and Content Guide	TBD

C. STAFF TECHNICAL POSITIONS

Staff Technical Positions have been divided into two types: Generic Technical Positions, dealing with issues which relate to licensing activities for repositories independent of the technology or site selected; and Site Technical Positions, which give site specific guidance/advice.

1. SITE TECHNICAL POSITIONS (STP'S)

STP's provide a format for establishing the staff's positions on site specific issues. The set of STP's for a given site provides a means of tracking and tracing positions taken by the staff. Issue-oriented Site Technical Positions (ISTP's) are generated in each technical review area (hydrogeology, etc.) for each site. ISTP's constitute what the staff considers to be a systematic and comprehensive identification of issues which need to be resolved for licensing. Other detailed STP's are issued as appropriate throughout the pre-licensing period. They establish acceptable methods of analysis, minimum information needs, or acceptable methods of data gathering and form the basis for tracking issues over time.

**Under revision to reflect NWPA-1982 and experience of prelicensing consultation. Revised guide expected to be issued in FY85.

The concept of STP's was developed to provide maximum flexibility in completing a series of technical positions that have sufficient formality to record staff positions and to notify the prospective licensee (DOE). STP's (other than ISTP's) will be initiated by the need for documentation of a staff concern or in response to a major question raised by the licensee.

a) Issue-oriented Site Technical Positions (ISTP's)

The ISTP's were coordinated with DOE/NRC workshops in individual program areas.

TITLE	ISSUE DATE
BWIP	
(i) Geology/Geophysics (Draft)	September 1984
(ii) Geochemistry (Draft)	September 1984
(iii) Waste Package (Draft)	September 1984
(iv) Repository Design/Rock Mechanics (Draft)	September 1984
(v) Hydrogeology (Draft)	September 1984

NNWSI

(i)	Geology/Geophysics (Draft)	September 1984
(ii)	Geochemistry (Draft)	September 1984
(iii)	Waste Package (Draft)	September 1984
(iv)	Repository Design/Rock Mechanics (Draft)	September 1984
(v)	Hydrogeology (Draft)	September 1984

SALT

(i)	Geology/Geophysics (Draft)	September 1984
(ii)	Geochemistry (Draft)	September 1984
(iii)	Waste Package (Draft)	September 1984
(iv)	Repository Design/Rock Mechanics (Draft)	September 1984
(v)	Hydrogeology (Draft)	September 1984

b) Other STP's

BWIP

(i)	Hydrology Testing Strategy (Draft)	December 1983
(ii)	Solubility (Draft)	TBD
(iii)	Hydrazine Testing (Draft)	TBD
(iv)	Others as Identified	

TITLE ISSUE DATE

NNWSI

(i) Others as Identified

SALT

(i) Others as Identified

2. GENERIC TECHNICAL POSITIONS (GTP'S)

The specific issues that must be addressed in a potential licensing case will be site specific. Therefore, the principal mechanism for documenting guidance is through the site specific guidance described in the SCA section II.A. above, and in section II.D. (Technical Meetings). Notwithstanding this, some issues can be grouped in generic non-site specific categories. From the experience gained in the consultation process at various sites, the staff is identifying areas where it would be useful to document guidance in this generic fashion. For the most part, this would involve repetition of staff positions already developed and documented. The following lists generic technical positions already developed or under development. Also listed are technical areas where the staff is tentatively considering developing GTP's.

o Waste Package Reliability (Draft)	October 1984
o Sorption (Draft)	October 1985*
o Matrix Diffusion (Draft)	TBD
o Groundwater Travel Time (Draft)	November 1985*
o Borehole and Shaft Seals (Draft)	July 1983
o Determination of Radionuclide Solubility in Groundwater for Assessment of High-Level Radionuclide Waste Isolation (Final)	November 1984
o In-Situ Testing During Site Characterization (Draft)	September 1984
o Design Information Needs--SCP/Conceptual Design Phase (Draft)	April 1985*
o Design Information Requirements--Licensing Review Phase	TBD
o Seismo-Tectonic Evaluation Methodology (Draft)	December 1985*

*Projected Issue Date

ATTACHMENT E

NRC NUCLEAR WASTE POLICY ACT REQUIREMENTS

I. NRC Role in Repository Development Program

Provision	NWPA Date	Current Schedule	NRC Role
1. Section 112(a)-Siting Guidelines promulgated by DOE in which NRC concurs.	7/6/83	12/84	NRC must concur in DOE Guidelines. Action Taken After review and comment on draft DOE guidelines in early 1983, NRC received final siting guidelines on November 23, 1983. NRC held oral presentations on January 11, 1984, and public comments were received through February 1, 1984. On February 29, the Commission gave tentative endorsement to the guidelines and stated that they would concur on the guidelines provided seven conditions were met. Following six meetings between DOE and NRC staff to resolve these conditions, final siting guidelines were received by NRC on May 15, 1984. The Commission voted to concur on the guidelines on June 22, 1984. Current Status- DOE published the final guidelines on December 6, 1984. On December 24, 1984, the staff forwarded a paper to the Commission (SECY-84-482) recommending that the Commission does not have to concur in the supplementary information to the final guidelines. The staff is currently awaiting Commission action on this recommendation.
2. Section 121(b)-NRC must promulgate technical requirements and criteria.	1/1/84	Promulgated 6/21/83	NRC must issue regulations which specify the technical requirements and criteria for the repository. Current Status- The regulations, which were under development by the staff for several years, were published in the Federal Register on June 21, 1983 (48 FR 28194).
3. Section 121(a)-EPA final high-level waste standards promulgated.	1/7/84	6/85	Section 121(b) regulations and criteria must be revised by the Commission, if necessary, to comply with standards being prepared by EPA Actions Taken- NRC's comments on the proposed standards were transmitted to EPA on May 10, 1983. Current Status- EPA currently plans to issue its final high-level waste standards by June 1985. NRC will review its high-level waste criteria for conformance with EPA standards after the final standards are published.

I. NRC's Role in Repository Development Program

Provision	NWPA Date	Current Schedule	NRC Role
4. Section 114(e)-DOE Project Decision Schedule.	None Specified	12/84	NRC must coordinate with DOE on the development of the Project Decision Schedule. Current Status- DOE issued a preliminary draft Project Decision Schedule for public comment on January 15, 1985 NRC comments are due to DOE on February 22, 1985.
5. Sections 216(a) and 301(b)- Draft Mission Plan published by DOE.	4/7/84	Published 5/84	NRC must coordinate with DOE on the development of the Mission Plan, and specify, with precision, any objections to the Plan. NRC received a preliminary draft on December 23, 1983 and sent comments directly to DOE on February 8, 1984. The draft Mission Plan required by the Act was released by DOE on May 8, 1984 and forwarded to NRC for review and comment by July 9, 1984. DOE briefed the Commission on the draft Mission Plan on June 27, 1984. Current Status- Staff comments were signed by the Chairman and forwarded to DOE on July 31, 1984.
6. Section 301(b)-Submission of DOE Mission Plan to Congress.	6/7/84	April 1985	Following Congressional approval of the Mission Plan, NRC will, wherever necessary, conform its waste management program planning guidance to the Plan. Current Status- DOE expects to submit the Final Mission Plan to Congress in April 1985.
7. Section 117(a)-Provision of information to States/Tribes.	In a timely manner		NRC must provide timely and complete information regarding its determinations or plans made regarding siting, development, or design for licensing, construction, operation, regulation, or decommissioning.
8. Section 112(b)-DOE recommends to the President 3 sites for characterization for first repository. Each of the 5 sites initially nominated for characterization must be accompanied by an Environmental Assessment.	1/1/85	Site recommendation Summer 1985	DOE will develop draft EA's on sites under consideration for nomination nomination after Commission concurrence on the siting guidelines. NRC staff intends to review and comments on EA's. Current Status- DOE issued draft Environmental Assessments for nine potential repository sites on December 20, 1984, and proposed to recommend sites in Nevada, Texas, and Washington for characterization. Comments on the draft EAs are due to DOE by March 20, 1985. DOE plans to publish final EAs and nominate and recommend sites in the summer of 1985.

I. NRC's Role in Repository Development Program

Provision	NWPA Date	Current Schedule	NRC Role
9. Section 8-President must evaluate the possibility of developing a defense-waste only repository.	1/7/85	2/85	If decision is to exclude defense waste from the civilian repository, NRC must license a separate defense-waste only repository. Current Status-Draft DOE report was issued in early August and reviewed by NRC staff. Comments were forwarded to DOE on October 15. DOE submitted a final report to the President in February 1985.
10. Section 113(b)-Submission by DOE of site characterization plan (SCP), waste form or package description, and conceptual repository design for each site to NRC.	Before sinking shafts	Spring 1986	NRC must review and comment on the submitted materials. Current Status-The first SCP is scheduled to be issued in the spring of 1986.
11. Section 114(a)(1)(E)-DOE sumbits to the President and the public the Commission's preliminary comments concerning at-depth site characterization and waste form sufficiency for DOE construction authorization application.	Prior to 13. below	Prior to 13. below	NRC must provide preliminary comments on the adequacy of the at-depth site characterization and waste form sufficiency for DOE construction authorization application.
12. Section 114(a)(1)(D)-DOE's final Environmental Impact Statement (EIS) on the first proposed repository must include comment from NRC on the draft EIS.	Prior to 13. below	3/90	NRC must review and comment on the draft EIS.
13. Section 114(a)(2)-President recommends one site to Congress for construction.	March 31, 1987 (may be extended one year if necessary)	1991	N/A

I. NRC' Role in Repository Development Program

Provision	NWPA Date	Current Schedule	NRC Role
14. Sections 116(b) and 118(a)-Submission of notice of disapproval by State or Indian tribe.	May 30, 1987 (or May 30, 1988 if #13 is extended)	1991	N/A; see 15 below
15. Section 115(g)-Congress may obtain any comments of the Commission with respect to a State/Tribal site disapproval.	Prior to 16. below	Prior to 16. below	NRC must be cognizant of State/Tribal concerns to be able to provide knowledgeable comments to Congress.
16. Section 115(c)-State/Tribal disapproval will take effect unless both Houses of Congress pass resolution of approval with in 90 calender days of continuous session.	About 8/87 (or 8/88 if #13 is extended)	1991	N/A; see 15 above
17. Section 114(a)(3)-Within 1 year after dissapproval, the President must recommend an alternative site for the first or a subsequent repository.	8/88 (or 8/89)	1992	Role similar to initial site recommendation. See events 11-15, above.
18. Section 114(b)-Secretary submits construction authorization application to NRC.	8/87(or 8/88)	1991	An NRC licensing proceeding will be initiated on the construction authorization application.
19. Section 114(c)-NRC must submit status report.	One year after submittal of the construction authorization application and annually thereafter.	1992	NRC must submit an annual status report on the progress of the licensing proceeding to Congress.

I. NRC's Role in Repository Development Program

Provision	NWPA Date	Current Schedule	NRC Role
20. Section 114(d)-Commission must issue decision on construction authorization for first repository.	1/1/89 or 3 years after application submitted, or 4 years after submittal if extended	1994(1995)	3 year time period for NRC decision dictates an active program of involvement with DOE, States/Tribes prior to receipt of application to identify and resolve contentious issues to the maximum extent practicable. Commission will either grant or deny authorization for DOE to begin construction of the first geologic repository. To meet this schedule, a relatively complete, good quality DOE application will be required.
21. Section 112(b)(1)(c)-Secretary must recommend 3 sites for characterization to President for second repository.	7/1/89	7/1/89	Same as event 8 above. Current Status- NRC anticipates that pre-SCP workshops will begin in FY86 and an SCP will be received for review in FY89.
22. Section 114(a)(2)(A)-President must recommend to Congress 1 site, from sites already characterized, for second repository.	3/31/90 (may be extended one year).	10/95	Same as events 10, 11, and 12 above.
23. Section 114(b)-Submission of construction authorization application to NRC for second repository.	About 11/90	12/95	NRC will initiate licensing proceeding for second repository.
24. Section 114(d)-Commission must issue decision on issuing construction authorization for second repository.	1/1/92 or 3 years after application submitted, or 4 years after submittal if extended.	12/98 12/99	3 year time period for NRC decision dictates an active program of involvement with DOE, States/Tribes prior to receipt of application to identify and resolve contentious issues to the maximum extent practicable. To meet this schedule, a relatively complete, good quality DOE application will be required.

II. NRC's Role in the Test and Evaluation Facility Program

Provision	NWPA Date	Current Schedule	NRC Role
25. Section 213(a)- DOE is authorized but not required to issue T&E facility siting guidelines	7/7/83	DOE has not announced	Current Status- No guidelines have been issued. NRC will provide the required consultation if and when the guidelines are issued.
26. Section 216(a)-TEF cooperation and coordination.	None specified		NRC shall assist the Secretary by cooperating and coordinating on any reports under Title II. Current Status- No action taken. DOE planning to make a determination on a collocated TEF in FY87.
27. Section 217(f)(1)-NRC, DOE must conclude written agreement on procedures for T&E facility interaction.	1/6/84	Not scheduled	NRC must work with DOE in developing a written agreement for procedures for review, consultation, and coordination in the planning, construction and operation of the T&E facility. Such an understanding shall also establish the types of reports and other information as the Commission may reasonably require to evaluate health and safety impacts of the T&E facility. Current Status- No agreement has been reached. DOE reported to Congress on April 6, 1984 their decision that if a TEF is necessary, it should be collocated, but that the decision on the need for a TEF is being delayed until the program's data needs are better established, now planned for late 1987.
28. Section 217(f)(3)(A)-NRC shall carry out a continuing analysis of the T&E activities to evaluate the adequacy of the consideration of public health and safety issues.	None specified		As provided
29. Section 217(f)(3)(B)-NRC required to report to the Secretary, the President, and the Congress as it deems appropriate.	None specified		As provided

II. NRC' Role in the Test and Evaluation Facility Program

Provision	NWPA Date	Current Schedule	NRC Role
30. Section 217(h)-NRC must concur on decontamination and decommissioning of DOE's T&E facility.	Five years after initial operation		NRC will evaluate DOE's decontamination and decommissioning activities, and concur, if deemed appropriate for a T&E facility not located at the site of repository.

III. NRC's Role for Interim Spent Fuel Storage

Provision	NWPA Date	Current Schedule	NRC Role
31. Section 132-The Secretary, the Commission, and other authorized federal officials shall each take such actions as such officials consider necessary to encourage and expedite the effective use of available storage, and necessary additional storage, at the site of each civilian nuclear power reactor.	No specific dates		The Commission will consider which actions are necessary to implement the intent of this provision.
32. Section 134-Hybrid procedures are prescribed for hearings on certain applications for licenses for facility expansions of spent fuel storage capacity and transshipments of spent fuel.	No specific dates, but applicable to applications filed after 1/07/83	Final rule 3/85	A proposed rule establishing procedures for expansion of onsite spent fuel storage capacity or transshipment of fuel was published on December 5, 1983. Two options were identified, either requiring the use of hybrid hearing procedures in all Section 134 proceedings or permitting their use at the request of any party to the proceedings. Comment period was extended to February 20, 1984. The staff is currently analyzing the public comments and determining whether to recommend adoption of a final rule based on one of the options identified in the proposed rule, or to develop a new proposal based on comments received. Current Status- A final rule is scheduled to be submitted to the Commission in March 1985. The effort has been delayed due to priorities on regulatory reform.
33. Section 135(g)-Issuance of NRC proposed rule establishing procedures and criteria for making a determination that onsite storage cannot reasonably be provided at a reactor and that the person owning and operating the reactor is diligently pursuing licensed alternatives to the use of Federal storage capacity.	4/7/83	Final criteria 1/85	As provided. A proposed rule was published April 29, 1983. Comments received during the public comment period which ended June 28, 1983 have been reviewed. Current Status- Final criteria were submitted to the Commission on November 7, 1984. The criteria were approved by the Commission on January 10, 1985 and will be published shortly.

III. NRC's Role for Interim Spent Fuel Storage

Provision	NWPA Date	Current Schedule	NRC Role
34. Section 135(a)-If the NRC determines that onsite storage cannot reasonably be provided at a reactor by the licensee, DOE may, under certain conditions, provide not more than 1900 metric tons of capacity for storage of spent nuclear fuel from civilian power reactors.	Not specific		NRC will make public health and safety determinations as to the use of any existing DOE facility for spent fuel storage and will license storage in new structures, including modular or mobile spent nuclear fuel storage equipment such as dry casks, as required under this provision of the Act
35. Section 137(a)-Transportation of spent nuclear fuel to a DOE storage facility shall be subject to licensing and regulation by NRC and by the Department of Transportation.	Not specific		NRC is required to review DOE's applications for shipment and make licensing determinations for health and safety and safeguards.
36. Section 137(b)-DOE, in providing for the transportation of spent nuclear fuel under this Act, shall utilize by contract private industry to the fullest extent possible in each aspect of such transportation.	Not specific		NRC will be required to review the private contractor's application for shipment, and make licensing decisions for health and safety and safeguards. Regulations may, at a future date, be modified or revised to conform with DOE's repository program.

III. NRC's Role for Interim Spent Fuel Storage

Provision	NWPA Date	Current Schedule	NRC Role
37. Section 218(a) and 133-NRC shall by rule establish procedures for the licensing of any technology approved by the NRC for use at the site of any civilian nuclear power reactor. NRC may by rule approve one or more dry spent fuel storage technologies for use at the sites of civilian power reactors without, to the maximum extent practicable, the need for additional site specific approvals.	Not specific		NRC, using data and information from DOE dry storage demonstration and cooperative programs, will develop regulations to approve dry technology storage at civilian nuclear power reactors without, to the maximum extent practicable, the need for additional site specific approvals by the NRC.
38. Section 216(a)-Interim Spent Fuel Storage Cooperation and Coordination.	None specified		NRC shall assist the Secretary by cooperating and coordinating on any reports under Title II.

IV. NRC's Role in Monitored Retrievable Storage Program

Provision	NWPA Date	Current Schedule	NRC Role
39. Section 141(b)(3)-DOE shall consult with the Commission and EPA in formulating the MRS proposal and shall submit their comments on the MRS proposal to Congress along with the proposal.	6/1/85	6/1/85	NRC will consult with DOE on development of the MRS proposal, and provide comments to DOE for submittal of the proposal to Congress. Current Status- DOE submitted an MRS research and development plan to Congress on June 23, 1984
40. Section 141(c)(1)-Submission by Secretary of an environmental assessment with respect to the MRS proposal to Congress.	6/1/85	6/1/85	NRC may, if it deems appropriate, comment to DOE on this environmental assessment (EA).
41. Section 141(d)-DOE shall file for license with NRC for MRS.	Subject to Congressional authorization of MRS	Subject to Congressional authorization of MRS	NRC will develop amendments to 10 CFR Part 72 to provide the licensing framework for the MRS, if it should be authorized by Congress. If authorized NRC will review DOE's application and make the necessary licensing determinations. Current Status- Proposed revisions to 10 CFR Part 72 are scheduled to be submitted to the Commission in the spring of 1985.

V. NRC Role in the Low-Level Waste Management Area

(No deadlines were provided in the Act for the LLW management provisions under Section 151).

Provisions	NRC Role
42. Section 151(a)(1)-Commission authorized to establish regulations or other such standards and instructions as it deems necessary or desirable to ensure that each LLW disposal licensee will have adequate financial arrangements for decontamination, decommissioning, site closure and reclamation of sites, structures, and equipment used in conjunction with its LLW disposal.	New sites are covered by existing regulations (10 CFR Part 61). NRC will review existing regulations and guidance for application at the existing commerical LLW disposal sites.
43. Section 151(a)(2)-If Commission determines that long-term maintenance or monitoring will be necessary at a LLW disposal site, Commission must ensure before termination of the license that the licensee has made adequate financial arrangements. Monitoring will be carried out by the person having title and custody for such following license termination.	May require rulemaking by the Commission and the development of guidance for both existing and new commercial LLW disposal sites. For existing sites, analyses will be required to assess long-term performance; monitoring and long-term maintenance requirements; associated costs; and the programs to review monitoring data to identify the need for mitigative actions
44. Section 151(b)-DOE shall have the authority to assume title and custody of LLW and the land on which such waste is disposed of, upon the request of the owner of such waste and land following termination of the license issued by the Commission for such disposal, if 1) the Commission determines that the requirements for site closure, decommissioning and decontamination have been met with pursuant to Section 151(a); 2) that such title and custody will be transferred to the DOE without cost to the Federal government; and that Federal ownership and management is necessary, or desirable to protect the public health and safety.	Likely to require rulemaking/guidance to provide basis for required Commission determinations Such rulemaking/guidance would require close coordination of DOE which appears to have independent discretion to accept sites following Commission determination.

Provisions	NRC Role
45. Section 151(c)-Adequate financial arrangements for long-term maintenance and monitoring, as well as decontamination and stablization of special sites must be met in accordance with requirements established by the Commission before DOE may assume title and custody of the waste and the land on which it is disposed.	Similiar to event 44 above.

VI. NRC's Role Relating to Other Provisions in the Act

Provisions	NWPA Date	Current Schedule	NRC Role
46. Section 223(b)-By April 7, 1983, DOE and NRC must publish a joint notice in the Federal Register stating that the U.S. is prepared to cooperate and provide technical assistance to non-nuclear weapon states in the field of spent fuel storage and disposal.	4/7/83 Annual revisions required	Completed 3/30/83. Update published April 6, 1984	NRC will prepare a joint Federal Register notice with DOE and will provide technical assistance to non-nuclear weapon states pursuant to the Act and the FR notice. NRC and DOE will update and reissue this notice annually for 5 years, as required. An FR notice was published following coordination with DOE, ACDA, and the State Department on March 30, 1983. Current Status- The first annual update of the notice was published in the Federal Register on April 6, 1984.
47. Section 302(b)(1)(A)-The Commission shall not issue or renew a license to use a utilization or production facility under Section 103 or 104 of the Atomic Energy Act unless the applicant has entered into a waste disposal contract with the Secretary of Energy or the Secretary affirms in writing that the licensee is negotiating in good faith to enter into such a contract. Section 302(b)(1)(B)-The NRC in its discretion may require as a precondition to the issuance or renewal of a reactor license that the applicant shall have entered into an agreement with DOE for the disposal of high-level waste or spent fuel that may result from such a license.	6/30/83		The final waste disposal contract proposal was published by the DOE in the Federal Register on April 18, 1983. All necessary contracts were signed and received by the DOE on or before the June 30, 1983 statutory deadline.

Provision	NWPA Date	Current Schedule	NRC Role
48. Section 303-DOE shall consult with the Chairman of the NRC in conducting a study of alternative approaches to managing construction and operations of all civilian waste management facilities, and then DOE is to report to Congress.	1/6/84	1/85	At the invitation of the Secretary, the Chairman will consult on the "alternative approaches" study. Actions Taken-DOE chartered an Advisory Panel on Alternative Means of Financing and Managing Radioactive Waste Facilities (AMFM) to assist them in conducting the required study. As part of the consultation process, DOE extended the invitation to have an NRC observer attend the AMFM Panel meetings. The Panel held ten meetings between January and November 1984, which were attended by NRC staff observers, and toured DOE waste facilities at Hanford, NTS, and WIPP. Current status-The Panel held its tenth and final meeting on November 13 and 14, including a meeting with Secretary Hodel on November 14 to discuss their recommendations and forthcoming report. A final draft of the report received by NRC on December 5, concludes that several organizational forms are more suited than DOE for managing the waste program, and identifies a public corporation as its preferred alternative. The report also recommends adoption of several specific program components which are independent of the type of organization ultimately chosen to handle the program, including an Advisory Siting Council. The staff has reviewed the final draft report and will submit comments to the Commission after DOE submits the final report to the Commission for consultation, [redacted] now expected by the end of February 1985.

Provision	NWPA Date	Current Schedule	NRC Role
49. Section 306-NRC is required to promulgate regulations or other suitable guidance for the training and qualifications of civilian nuclear power plant personnel and submit a report to Congress on its activities under this action.	1/6/84	TBD	As provided. Actions Taken-The required report was submitted to Congress on January 20, 1984. A proposed rule was forwarded to the Commission on February 13, 1984. In a briefing before the Commission on April 9, 1984, nuclear industry representatives voiced their opposition to the rule and recommended adoption of INPO's accreditation program as a substitute. NRC staff modified the proposed rule, but at a June 26, 1984 Commission meeting industry expressed continued opposition to the rule. The staff then recommended that the Commission publish two alternative training rules for public comment. One, prepared in response to the Chairman's request, would have required accreditation of licensees' training programs, such as by INPO. The second, a revision of the approach the staff proposed in February, specified the basic elements of an acceptable training program and stated that accreditation was the expected means of implementation. Industry indicated that their commitment to the INPO accreditation program would have to be reevaluated if any form of training rule was promulgated. Current Status-As a result of meetings with industry representatives on October 12 and with staff on October 17, the Commission decided to publish proposed amendments to Part 55 dealing with simulator training requirements (published 11/26/84), but will not propose amendments to Part 50 on training and qualifications requirements of plant personnel. In lieu of the Part 50 amendments, the staff has prepared a policy statement, whereby industry would be allowed two years under the INPO accreditation program. The program would be monitored by NRC and reevaluated at the end of the two year period.

ATTACHMENT F

PRINCIPAL NRC NWPA ACTIVITIES FOR FY86-87

SITE-SPECIFIC

Review and comment on SCP
Review and comment on initiation of shaft construction and in-situ testing
Concur in use of radioactive material in site characterization

REGULATORY CHANGES

Revise Part 60 to conform to EPA standard
Revise definition of high-level waste
Clarify definition of disturbed zone
Include unsaturated zone
Procedural amendments on site characterization and State/Tribal participation
Revise Parts 60 and 51 to conform NEPA requirements to NWPA
Rulemaking on methods to demonstrate compliance with 10 CFR Part 60
Develop safety and environmental criteria for generic licensing of dry spent fuel storage casks
Revise 10 CFR Part 72 to include MRS facilities

GUIDANCE

Generic Technical Positions
LA Format Guide
Data Review and Other Guidance
Non-site specific reports, technical guidance, methods, models and codes on the repository geologic setting and on repository design and the engineered barrier system
Site Screening Investigations
State/Tribal Relations
Development of requirements on decommissioning of low-level waste sites with zirconium, hafnium, are rare earths
Technical guidance to DOE, DOT, States and industry on safety and environmental policy/regulations for shipment of spent fuel/HLW to MRS, EIS, repository
Onsite licensing representation

STONE & WEBSTER ENGINEERING CORPORATION

245 SUMMER STREET, BOSTON, MASSACHUSETTS

ADDRESS ALL CORRESPONDENCE TO P.O. BOX 2325, BOSTON, MASS. 02107

JOHN W. LANDIS
Senior Vice President

February 19, 1985

The Honorable Marilyn L. Lloyd
Chairman, Subcommittee on Energy
  Research and Production
Committee on Science and Technology
Rayburn House Office Building, Rm. B-374
Washington, DC 20515

Dear Madam Chairman:

Relative to the Congressional hearings, commencing February 21, 1985, on the Department of Energy's nuclear energy budget, a joint statement has been respectfully submitted for the Congressional Record outlining the unified recommendations of the current industrial and utility participants in the DOE High Temperature Gas-cooled Reactor (HTGR) Program. Stone and Webster Engineering Corporation (SWEC) is a signatory to this joint statement.

SWEC is not currently scheduled as a witness in your hearing agenda. We therefore wish to submit, again for the Congressional Record, a supplementary statement expanding on the thoughts contained in the joint statement.

SWEC has been an active participant in the DOE HTGR Program for the past year. Our principal assignment has been the development of the Pre-stressed Concrete Reactor Vessel (PCRV) HTGR configuration. We were also a major contributor to the comprehensive evaluation effort that led to the decision to select the steel-vessel modular design as the preferred concept for initial deployment and to focus available resources on this concept in the near term.

Our support of this concept is based not only on work done during the past year but also on over a decade of previous work by SWEC on utility HTGR projects. This long experience has given us a good perspective on the HTGR and considerable capability for evaluation of alternative designs. It is from this vantage point that we strongly support the initiation of a full-scale Licensing and Technology Test Project as the most effective next step in the DOE HTGR Program.

This supplementary statement is respectfully submitted primarily as further evidence of our advocacy of the modular HTGR and its development for commercial activity.

Very truly yours,

JW Landis

John W. Landis

JWL:bg

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Republican Staff Director

April 18, 1985

Hon. Lee Thomas
Administrator
U.S. Environmental Protection Agency
Washington, D.C. 20460

Dear Mr. Thomas:

We have discovered a discrepancy between the testimony provided by the EPA on March 4, 1985 before the Subcommittee and the testimony provided by the Department of Energy. Since the discrepancy involves the work now being completed at the EPA on nuclear waste material release standards, I believe it is important that this issue be clarified as soon as possible.

Mr. Meyers, EPA's Acting Director of the Office of Radiation Programs, testified in response to a question that "In all the meetings I have had with them [DOE] they never once raised the issue of not being able to meet that [EPA's] societal objective." Transcript pages 74 and 75 are attached. The DOE in response to our written question disputed EPA's statement, writing, in part, that "DOE has commented to the EPA on numerous occasions regarding the possible difficulties in showing compliance with the proposed EPA Standard." Subcommittee question and DOE response are attached.

We would appreciate your explanation of this difference of opinion at your earliest convenience.

Sincerely,

Marilyn Lloyd

MARILYN LLOYD, Chairman
Subcommittee on Energy
Research and Production

ML:VJs

ENVIRONMENTAL STANDARDS

QUESTION 7: The Environmental Protection Agency testified before the Subcommittee that DOE has not commented to them on the difficulty of proving compliance with EPA's proposed standards. Others have stated that because EPA's proposed standards set limits at the practical level of achievability, and because the Nuclear Regulatory Commission requires large margins of assurance that these standards will be met, DOE will find it extremely difficult to comply. Have you commented to EPA on this issue, and if not what is your opinion on this issue?

ANSWER: DOE has commented to the EPA on numerous occassions regarding the possible difficulties in showing compliance with the proposed EPA Standard. Specific examples of these comments are the letter from W. A. Vaughan (DOE Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness) to the EPA on May 2, 1983, that provided written comments on EPA's proposed draft standard, and in the testimony of M.J. Lawrence (Acting Deputy Director of DOE's Nuclear Waste Policy Act Project Office) during EPA's May 12, 1983 hearing on the proposed standard. These comments stressed the unnecessary conservatism of the EPA approach, the inevitability of additional conservatism being added by the NRC and DOE's potential difficulty inconclusively demonstrating compliance with the standard given the probabilistic and very long term nature of the problem. DOE is continuing to work with the EPA to provide further comments directed toward development of a workable standard and is optimistic that DOE will be able to demonstrate compliance with such a standard.

RPTS TARTARO

DCMN ULMER

[3:00 p.m.]

Mrs. LLOYD. Thank you very much, Shelly. We appreciate your testimony. I want to refer to something I have written to you about previously, that the EPA has proposed material release standards relative to the repository that had been characterized as you know as very stringent and perhaps overly conservative. Some have charged that EPA's release standards combined with conservative requirements imposed by the NRC will make it very difficult for the Department of Energy to find the technology that can be proven to meet the standards in the regulatory process. I would like your comments on this today.

Mr. MEYERS. As I said in the testimony, we have been working very closely with the Department of Energy, and in all the meetings I have had with them they never once raised the issue of not being able to meet that societal objective. Our calculations on our own account and working with the NRC show that they will be able to make those societal objectives with ease. I was rather surprised to hear the question raised because it had never come up before. But based upon the information that we have in our own calculational models, working with NRC and the fact it was just never brought up by the Department of Energy, we are trying to put out a standard that is both protective of public health but achievable.

Mrs. LLOYD. This is something I wanted to be included in the record and something we will pursue further with DOE.

Secondly, would you clarify your statement on why EPA rejected the advice of its Science Advisory Board to institute the 10-fold reduction in the nuclide release limits?

Mr. MEYERS. Surely. Those particular numbers, the thousand health effects and 10,000 years, came about by both analysis of how repositories would perform and also by comparing them with the kind of releases one would achieve from natural uranium bodies. And when you look at numbers and the long period of time involved, we felt that we wanted to give the kind of confidence that I think the public demands and also that DOE can meet in terms of that societal objective of 1,000 health effects over 10,000 years. The SAB was not unanimous in their recommendation and were over--it was not a scientific subject. It is the kind of decision that the Administrator tends to make in our Agency, and thus far our office has felt that it would be far better to retain that thousand years or that 1,000 health effects in 10,000 years so that the public can have a higher degree of assurance that the Federal Government is doing what they can to protect them from wherever this repository is

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAY 21 1985

THE ADMINISTRATOR

Honorable Marilyn Lloyd
Chairwoman
Subcommittee on Energy
Research and Production
Committee on Science and Technology
House of Representatives
Washington, D.C. 20515

MAY [illegible]

Dear Ms. Chairwoman:

This is in response to your letter dated April 18, 1985, in which you note an apparent discrepancy between the testimony presented by Sheldon Meyers, Acting Director of the office of Radiation Programs, before your Subcommittee on March 4, 1985, and the testimony provided by the Department of Energy (DOE).

The DOE response, which mentions "possible difficulties" in showing compliance with the proposed Environmental Protection Agency (EPA) High-Level Waste (HLW) standard, derives from a May 2, 1983, letter from W.A. Vaughn, DOE's Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness and also the testimony of M.J. Lawrence, Acting Deputy Director of DOE's Nuclear Waste Policy Act Project Office, during EPA's May 12, 1983, hearing on the proposed HLW standard. Needless to say, over the period of time of almost two years since DOE voiced its concern, we have made many changes in the proposed HLW standard, including our use of less conservative assumptions in our modeling analysis. Such an approach resulted in a radionuclide release rate that on average is seven-fold less restrictive than that which was originally proposed. In the aggregate, these changes have helped to lessen DOE's initial concerns about meeting the HLW standard.

With regard to Mr. Meyers' testimony, I should point out that shortly after he was appointed to his current position, Mr. Meyers arranged a series of meetings with DOE to pinpoint outstanding issues that required resolution before the final EPA standard could be promulgated. In the course of these meetings, ten issues were raised, most of which have now been resolved. We continue to work towards resolving the remaining ones. DOE did not, in any of these meetings, raise the issue of not being able to meet the societal objective of 1000 health effects in 10,000 years. During telephone conversations on April 24 and 25, 1985, DOE officials who were present at these meetings confirmed to Mr. Meyers that they had not raised the issue of not being able to meet the societal objective during any of those recent meetings.

It was clear from the very first meeting that both DOE and EPA were prepared to work towards resolving the outstanding issues so that a standard which was both protective of the public health and achievable could be promulgated without undue delay.

Sincerely,

Lee M. Thomas

Lee M. Thomas

APPENDIX II

Supplemental Questions and Answers for the Record

Department of Energy
Washington, D.C. 20585

March 14, 1985

Honorable Marilyn Lloyd
Chairman, Subcommittee on Energy
  Research and Production
Committee on Science and Technology
House of Representatives
Washington, D.C. 20515

Dear Madam Chairman:

On February 20, 1985, Acting Assistant Secretary James W. Vaughan, Jr. appeared before your Subcommittee to discuss the FY 1986 Department of Energy authorization request for the Civilian Reactor Development Program and Advanced Nuclear Systems.

Following that hearing you submitted written questions to supplement the record. Enclosed are the answers to those questions which also have been sent directly to the Committee staff.

If you have any questions, please call Diana Diamond or Cathy Hamilton of my staff on 252-4277. They will be happy to assist you.

Sincerely,

Robert G. Rabben
Assistant General Counsel
for Legislation

Enclosures

LIQUID METAL REACTOR PROGRAM

Question 1: What is the Department's plan for industry's participation in the Liquid Metal Reactor program in the out-years past FY 1986? Will this plan represent the total investment, including industry contributions, to the new initiative activity?

Answer: There is broad electric utility industry and industrial participation in the Liquid Metal Reactor (LMR) program currently in place and planned for continuance beyond FY 1986.

As you are aware, the U.S. Department of Energy (DOE) has entered into contracts with two corporations, Rockwell International (RI) and General Electric (GE), to develop LMR innovative designs. The planned contract period is for 39 months beginning December 1984 and extending through February 1988. In addition to the Government funding, the industry participants are contributing funding of approximately $1 million annually. The contributed funding is being applied primarily in the areas of marketing studies and planning. RI and GE are also planning to conduct marketing efforts to identify private sector customers for their advanced concept plants.

Both the Electric Power Research Institute (EPRI) and the Advanced Reactor Corporation (formerly the Breeder Reactor Corporation), representing utility interests, are

Answer 1: (continued)

participating in the LMR program. EPRI has agreed to maintain its Consolidated Management Office facilities and personnel through FY 1986 to prepare a large LMR pool design that will be used to support our international collaboration programs. EPRI has extended its agreement with DOE a number of times and an extension covering activities beyond FY 1986 can be expected. The Breeder Reactor Corporation, a consortium of utilities that played a prominent role in the management of the Clinch River Project, will continue to represent utility interests under the new name of Advanced Reactor Corporation.

Industry-sponsored efforts are being conducted in LMR facilities. The Transient Reactor Test Facility at Argonne National Laboratory is currently supporting EPRI's LWR Source Term Experiments Program (STEP). Hanford Engineering Development Laboratory's (HEDL's) containment system test facility is being used in LWR Aerosol Containment Experiments (LACE), also an EPRI-sponsored effort. Utilization of these facilities in EPRI studies is expected to continue beyond FY 1986.

LMR technology has potential applicability in space and defense programs and, therefore, laboratories and industrial contractors are conducting LMR research and development for these programs. LMR contractors are potential contractors for future space reactor development efforts and for developing a secure reliable electricity generator for critical Air Force installations. Industrial contractors have already provided funding toward the development of LMR concepts to meet this Air Force requirement.

A1/2/3

LIQUID METAL REACTOR PROGRAM

Question 2: Please review for the Committee the impact of the FY 1986 budget on the major national labs participating in the LMR program, i.e., what percentage of the budget goes to each laboratory and how do these figures compare with last year's figures?

Answer: The preliminary allocation of the requested FY 1986 budget for the LMR and LMFBR programs and comparison to FY 1985 are as follows:

	Total Budget (LMR/LMFBR)	% to ANL	% to ETEC	% to HEDL	% to LANL	% to ORNL
FY 86	$213.4 M	26.8	7.2	37.6	0.5	2.4
FY 85	$251.4 M	28.2	7.9	39.9	1.3	3.4

The FY 1986 budget means overall funding reductions for all the program elements. In the program restructuring, great care was taken to keep the individual program elements viable in order to attain the stated overall management objectives. One aspect of the funding allocation was to keep the national laboratories viable entities in order to preserve the center-of-excellence concept. As the above funding allocation table shows, the relative reductions were even-handed, to avoid putting unfair burden on any one laboratory.

LIQUID METAL REACTOR PROGRAM

Question 3:	As a result of the FY 1986 budget reductions, how many people will be removed from participation in the LMR program and what percentage of these people represent professional, technical personnel? Will any of these people be reassigned to new tasks?
Answer:	We are working closely with our field offices and contractors to obtain an assessment of the manpower reductions associated with our requested FY 1986 budget. Our very preliminary assessment at this time is that approximately 800-1,000 people will be lost from LMR and LMFBR programs, of which approximately 50 percent are direct scientific personnel. We anticipate that some of these people will be assigned to other activities at the various laboratories and contractors; at this time, we do not have enough information to provide a reasonable estimate as to how many will be retained for other DOE program activities.

LIQUID METAL REACTOR PROGRAM

Question 4: What will be the principal activities of each of the national laboratories within the FY 1986 Liquid Metal Reactor program? What percentage of these activities will be in direct support of the new initiatives or innovative concepts presently contracted to General Electric and Rockwell?

Answer: Principal activities within each of the national laboratories for the FY 1986 Liquid Metal Reactor program are:

Hanford Engineering Development Laboratory (HEDL): Activities associated with long life core demonstration in the FFTF. Eighty-five percent of HEDL activities support innovative concept development. The remaining 15 percent of the HEDL program supports completion of the automated fuel fabrication line that will demonstrate safe, secure fabrication of Liquid Metal Reactor fuel, and supply fuel for continued FFTF operations.

Argonne National Laboratory (ANL): EBR-II and Hot Fuel Examination Facility operations and support international programs. Sixty percent of these activities are directed at development of increased safety margins for innovative concepts, e.g., shutdown heat removal systems. The remaining 40 percent support international agreements.

Answer 4: (continued)

Oak Ridge National Laboratory (ORNL): (1) Fuel cycle technology for remote operations and man-machine interface and control technology; (2) General Electric/Rockwell innovative design evaluations. Approximately 86 percent of this work supports the innovative designs directly and indirectly. The remaining 14 percent provides for improved materials and instrumentation.

Energy Technology Engineering Center (ETEC): Preparation for steam generator testing in the Sodium Components Test Installation. The data from these tests will support the selection of steam generator concepts for the GE and RI advanced designs. One-hundred percent of this activity supports the innovative designs.

Los Alamos National Laboratory (LANL): Reliability and risk assessment analyses. This work is 25 percent of the LANL effort and fully supports the innovative designs. The remaining 75 percent of LANL activities is directed at international agreements on carbide fuel.

LIQUID METAL REACTOR PROGRAM

Question 5: Over the past several years to these hearings we have received testimony on the Water Cooled Breeder Reactor program presently being undertaken within the naval reactors organization. This Committee has repeatedly expressed its view that this activity has no industry support. In view of the fact that we are facing such severe budget restrictions, and in view of the fact that we have had to curtail several critical tasks essential to the development of liquid metal breeder reactor technology, what is the justification for the expenditure of $19.7 million in FY 1986 for continuation of this activity? Please provide a detailed breakdown of the FY 1986 expenditures, by subtask, for both the defueling ($5.1 million) and core evaluation ($14.6 million) tasks.

Answer 5: The light water breeder being funded by the Water-Cooled Breeder program is a successful effort with 2-1/2 years left to completion. The program is efficiently run, is a major department investment, and should be completed to obtain the payoff. To do otherwise, would fail to reap the benefits of this long-term effort.

The light water breeder effort has demonstrated that a breeder core can be installed and operated in a pressurized water reactor. The reactor in the Shippingport Atomic Power Station successfully operated with a light water breeder core for five years achieving a capacity factor slightly better than the civilian nuclear power industry average.

The reactor was shut down in October 1982. The core was removed and the last fuel shipment to the Naval Reactors Facility in Idaho was completed in 1984. Core examination and physical determination of breeding performance are

LIQUID METAL REACTOR PROGRAM

Answer 5: (continued)

underway. This evaluation will be completed by the end of FY 1987 along with the parallel effort to clean up facilities, document the defueling and testing work, and prepare the fuel for storage.

Termination of the light water breeder effort in FY 1986, two years short of completion, would essentially waste 20 years of work and fail to validate a major investment. This is not in the best interests of the country. The light water breeder effort is proceeding smoothly and the technology demonstrated and now being proven has the potential to meet this country's electric power requirements for hundreds of years.

GAO addressed the question of completing the light water breeder effort in 1983 and, to quote GAO, "...the Department's planned approach is a cost-effective way of completing the program when compared to other alternatives". At the time of the GAO review, the total estimated cost to complete the program during fiscal years 1983 through 1987 was $157M. Today, the estimate over the same period is $148M and this includes only two years of estimated costs vice five. GAO also surveyed industry to determine interest in

LIQUID METAL REACTOR PROGRAM

Answer 5: (continued)

completing the light water breeder effort. The GAO found "...13 of 14 nuclear industry groups and utilities contacted by GAO expressed interest in obtaining the results of the fuel evaluation phase of the program". So it is simply not correct to conclude that there is no industry support.

The detailed breakdown of the FY 86 budget request is as follows:

WATER COOLED BREEDER BUDGET BREAKDOWN

(then-year $ in millions)

DEFUELING ACTIVITIES:

1. Fuel Receipt Storage and Disposal - includes drying and sealing spent fuel in storage containers, loading casks, and shipping spent fuel to Idaho Chemical Processing Plant.	$ 1.5
2. Facilities Clean-Up - decontamination of facilities which were used for Water Cooled Breeder program work.	$ 3.0
3. Technical Services Support - provides quality assurance, radiological control, and safety analysis support for defueling activities.	$ .4
4. Analysis and Documentation - prepare technical reports on the defueling process and end-of-life reactor tests.	$ .2
Subtotal: Defueling Activities	$ 5.1

LIQUID METAL REACTOR PROGRAM

Answer 5: (continued)

CORE EVALUATION:

1. Proof-of-Breeding and Core Examination Base - disassembly and dimension measurements of core components to obtain fuel rods for use in both breeding determination and material performance evaluations.	$ 9.5
2. Proof-of-Breeding - non-destructive assay	$ 1.5
3. Core Examination - fuel rod and support grid assessment	$ 1.5
4. Technical Services Support - provides quality assurance, radiological control, and safety analysis support for core evaluation activities	$ 1.1
5. Analysis and Documentation - assemble and evaluate test data, prepare technical reports on assay test data and fuel element and material examinations.	$ 1.0
Subtotal: Core Evaluation	$14.6
TOTAL: WATER-COOLED BREEDER	$19.7

A1/6/2

LIQUID METAL REACTOR PROGRAM

Question 6: General reductions to the Departmental budgets for program management initiatives amount to some $27 million across the Department's total R&D budget request. This figure represents one-half of a percent, approximately, of the total R&D budget submission of $5.1 billion. However, when we examine the management initiative reduction assigned to the Nuclear Energy programs, this amounts to 5% of the budget, or about $8 to $9 million. Could you please explain for the Subcommittee why the Department has chosen to assign one-third of its overall management initiative reduction to this particular program? Would it not be more equitable to distribute it across all programs, including the more than $2 billion of the R&D budget which goes for weapons research?

Answer 6: The Office of Nuclear Energy has been assigned a $9 million target where we estimate savings can be realized during FY 1986 in 2 of the Department's 16 specific initiatives: (1) savings from deobligations and (2) recoveries from Inspector General audits. The $9 million estimate is less than six percent of the $156.5 million Departmental total that has been spread over all program areas. For example, we hope to save over $52 million in FY 1986 from the Atomic Energy Defense Activities appropriation.

A1/7/3

LIQUID METAL REACTOR PROGRAM

Question 7: The Nuclear Fission R&D program, as envisioned by this Committee in its deliberations last year, would significantly redirect the emphasis away from the long-term breeder reactor concepts towards a more general and generic view of reactor designs that would meet near-term, intermediate-term, as well as long-term electric power requirements. In view of this fact, does the Department envision the liquid metal reactor as a competitor to such concepts as advanced light water reactor designs and the high temperature gas-cooled reactor, or rather do you believe as we do that the liquid metal reactor represents the ultimate future of nuclear power, as a transition to the breeder, and is complementary to rather than competitive with the more near-term reactor concepts?

Answer: We believe that the Liquid Metal Reactor (LMR) presents a significant potential to develop a marketable converter reactor concept that is economically competitive with other electrical generating alternatives. Such designs would, by their very nature, develop considerable design and supporting research and development information of value to the long-term breeder program. When it comes to converter applications, the market will have to determine whether the LMR, and its long-term extension, the Liquid Metal Fast Breeder Reactor, present sufficient attractiveness to engender financial and institutional support.

Each of the converter concepts has merit on its own. The high temperature gas-cooled reactor presents the potential of application for process heat needs of the future as well as having potential for small, modular electric power generation. The LMR, envisioned for commercial deployment in the 1990's as a converter reactor, will make a major contribution to the ultimate future of nuclear power since it can be easily converted to a breeder, and the advanced Light Water Reactor is based on a large amount of existing technology and operating experience and thereby appears to be a concept that is more easily achievable and deployable without prototype testing in the near term.

LIQUID METAL REACTOR PROGRAM

Question 8: Last year, subsequent to the Committee's authorization hearings recommendations were developed within the Committee and presented in the form of a report that suggested a redirection of the Nuclear Fission R&D efforts towards smaller, modular, passively safe reactor designs. In addition, it was suggested that directing the program towards designing reactors that are suitable for factory fabrication and design standardization would enhance the marketability of nuclear power in the future. It appears that the Department has essentially agreed with this Committee's recommendations as far as the FY 1986 budget for breeder reactors is concerned. In the Department's view, what does the federal program over the next 5 years or so look like? What can Congress expect the accomplishments to be for FY 1986 and beyond in liquid metal reactor research?

Answer: The program over the next 5 years addresses the technical and institutional problems that confront nuclear power in the United States.

This program is described in the draft strategy plan which has been provided to the Committee. The program is designed to protect the present investment, preserve the nuclear option for this country, and help achieve the full long-term potential of this energy source. More specifically, the program, through cooperative Government and industry efforts, will attempt to improve the economics and reliability of Light Water Reactors (LWRs) in operation, encourage the completion of those under construction, and remove the disincentives, both institutional and regulatory,

Answer 8: (continued)

which have caused nuclear power to be perceived as an unacceptable economic risk. In addition, the program will support technology that will be needed to develop a new generation of reactors and associated systems that have lower cost, increased reliability, improved passively safe capability, and that incorporate innovative features and concepts derived from advanced and emerging technologies. A principal program thrust will be the development of small, modular standardized designs, that provide for increased factory fabricability. Lastly, the program, partly through increased international participation, will develop the technology to ensure the future availability of an economic breeder reactor and fuel cycle when the marketplace so dictates. It is our objective, within the next 5 years, to complete Liquid Metal Reactor (LMR) conceptual designs; advance LWR, LMR and ATGR research and development (R&D); apply advances in the high technology field to all reactor designs; establish new licensing approaches for advanced reactors with the U.S. Nuclear Regulatory Commission, encourage reactor licensing reforms, and advance development of associated fuel cycle technology. If design progress so dictates, we would expect the marketplace to respond with an initiative to build an advanced reactor, and the Department to respond by carrying out its appropriate role of R&D support.

A1/9/3

LIQUID METAL REACTOR PROGRAM

Question 9: Please provide your projected program plan for the LMR program using the following format:

Answer:

($000)

Program Element	FY 1987	FY 1988	FY 1989	FY 1990
Liquid Metal Converter	$76,282	$80,033	$82,680	$85,194
Advanced Breeder Reactor Tech.				
Breeder Component Technology	$ 6,700	$ 6,400	$ 6,500	$ 6,400
Fuel Performance & Supply	19,600	15,100	15,100	15,100
Reactor Core Technology	6,100	5,600	5,600	5,600
Test Facility	96,593	89,700	91,600	90,800
Nuclear Fuel Cycle	18,200	17,600	17,600	17,600
Total Breeder	$147,193	$134,400	$136,300	$135,500
Civilian Reactor Dev Pgm Support				
University Program Support	$ 6,600	$ 6,900	$ 7,200	$ 7,400

The outyear estimate will be refined as we develop the FY 1987 funding request consistent with the goals and objectives of the restructured program.

LIQUID METAL REACTOR PROGRAM

Question 10:	In view of the fact that the Breeder Reprocessing Engineering Test (BRET) project initiated last year will not be funded in the Administration's FY 1986 budget request, what will be the direction of the Nuclear Fuel Cycle program in FY 1986?
Answer:	We will continue a base technology development effort, primarily at the Oak Ridge National Laboratory (ORNL). We will be able to maintain a level of expertise at ORNL and continue a moderate level of equipment and system testing in the Integrated Equipment Test (IET) facility there. Another activity will be to continue fuel cycle studies which will support the innovative reactor concepts and which will also provide a "baseline" for the IET cold-engineering work. An important element of the program that will be strengthened and expanded, as appropriate, is fuel cycle collaboration with the UK, Japan and others. The program will also include evaluation of methods and cask designs for handling and shipping irradiated LMR fuel.

A1/11/4

LIQUID METAL REACTOR PROGRAM

Question 11:	BRET was a critical element of the R&D program at the Hanford Engineering Development Laboratory (HEDL). What will be the level and direction of LMR fuel cycle activity at this Laboratory in FY 1986 now that BRET is gone?
Answer:	HEDL's involvement in the Fuel Cycle program will be limited to working with ORNL on the Fuel Cycle studies supporting the innovative reactor concept evaluations and on the spent fuel handling and shipping activity. The level of funding at HEDL for these two areas will be on the order of $200K-400K.

A1/12/4

LIQUID METAL REACTOR PROGRAM

Question 12:	The ultimate economic viability of the Liquid Metal Reactor is strongly dependent upon closing the nuclear fuel cycle for such reactors. Do you foresee any problems in proceeding with this important program?
Answer:	Commercial deployment of any LMR system will require that industry and the utilities are convinced that reprocessing capability exists and that reprocessing and its associated waste management do not involve unacceptable economic and technical risks. For this to happen, a "hot test" or "demonstration" of the technology is essential. It is generally recognized that reprocessing technology lags the other parts of the LMR fuel cycle.

LIQUID METAL REACTOR PROGRAM

Question 13: In view of the fact that the Department has initiated an innovative design activity with contractors that represents a significant change from prior year program direction towards large plant designs, what has been the response from the utility industry regarding this new approach towards reduced size and modularity in the nuclear steam supply system?

Answer: As part of the contracted effort with the Liquid Metal Reactor designers, General Electric and Rockwell International, a marketing activity has been initiated by each contractor to identify and incorporate utility responses and requirements into the new designs. These activities are only 3 months old. To date, the response has been positive in the sense that utilities are interested in the designs and are making a strong effort to participate in briefings and planning sessions.

LIQUID METAL REACTOR PROGRAM

Question 14: Can we expect the electric power industry to participate in the LMR program as they have participated in the past, i.e., with personnel and financial contributions?

Answer: We recognize the need for a continuing cooperative effort in the LMR program with the electric power industry and the reactor manufacturers. The former Breeder Reactor Corporation, a consortium of utilities that played such a prominent role in the management of the Clinch River Project, will continue to represent utility interests under the new name of Advanced Reactor Corporation. Both Rockwell International and General Electric are forming utility groups to provide utility input to their advanced reactor design projects. EPRI is maintaining its Consolidated Management Office facilities and personnel to extend the Large Scale Prototype Breeder design to include a large pool plant option.

All of these actions reflect the continued interest of the electric power industry and our efforts to continue the active relationship we have maintained in the past.

A1/15/3

LIQUID METAL REACTOR PROGRAM

Question 15: One of the stated goals for the Fiscal Year 1986 has been enhancement of international cooperative activities in the Liquid Metal Reactor program area. Could you give specifics as to the nature of this cooperative activity and specific tasks you hope to accomplish in FY 1986?

Answer: Enhancement of LMR related international cooperative activities during FY 1986 will be pursued with both Japan and the European community. It is our intent to revitalize relationships with both France and Germany with exchanges of information and participation in joint LMR development activities. In addition to the exchange of technology, there is a strong incentive to engage in design-related cooperative ventures. The most probable partner for the United States in this area during FY 1986 will be Japan, primarily because their MONJU activities can be meshed with U.S. experience on the Clinch River Breeder Reactor design.

Experiments in EBR-II on the operational reliability of oxide fuel and blanket components will be continued in cooperation with Japan. An advanced fuel test will be carried out in the FFTF in cooperation with Switzerland. A computerized reliability data base will be developed through joint efforts with Japan. TREAT transient measurements on LMR fuels will be carried out and analyzed in cooperation with the U.K. In summary, we will build on existing international agreements and selectively implement new arrangements for expansion of collaborative LMR research and development, design definition, and information exchange to the mutual benefit of the cooperating countries.

A1/16/3

LIQUID METAL REACTOR PROGRAM

Question 16: Has there been any interest expressed by foreign concerns in cooperative cost-sharing certain R&D activities in the Liquid Metal Reactor (LMR) program?

Answer: During the past 5 years, cooperative agreements on LMR technology have been implemented with the UK, Japan, Switzerland, France, and Germany. Most of these activities involve cost-sharing, either in the form of exchange of services or by transfer of funds from the foreign programs to the U.S. The major undertaking in the latter category is a joint DOE/Japan program on operational reliability testing of oxide fuel and blanket components. Experiments in EBR-II have been in progress since 1981. When the program is concluded, the Japanese will have provided over $13 million in support of the experimental program.

Another jointly funded program involving a Japanese contribution of over $6 million is to carry out criticality experiments in DOE facilities, the results of which would be available to both sides for use in facility design.

More recently, the Japanese have agreed to joint funding of the reliability data base, and the Swiss are providing resources for conducting an advanced fuel test in the FFTF. The UK is providing funds for to allow development tests in EBR-II.

A1/16/3

Answer 16 (continued)

Another cost-sharing proposal with the Japanese includes the development of Liquid Metal Reactor core technology for advanced reactor concepts being developed in Japan. The Japanese are considering using the Zero Power Plutonium Reactor located at Argonne National Laboratory-West in Idaho and the Tower Shielding Facility located at Oak Ridge, Tennessee. The Japanese have also expressed interest in a variety of joint fuels and materials development programs to utilize the unique capabilities of the Fast Flux Test Facility.

A1/17/3

LIQUID METAL REACTOR PROGRAM

Question 17: The Department has proposed initiation of a technology transfer activity within the Civilian Reactor Development program. What particular activities within this function will be part of the Liquid Metal Reactor programs?

Answer: Technology transfer activities include construction of data bases for Liquid Metal Reactors (LMRs) and all of the advanced reactors, state-of-the-art assessments to aid in idea generation for innovative designs, the tracking and utilization of nuclear technology developments in foreign countries and the planning and organizing of a high technology program that will have applications across all advanced designs. The high technology program will focus on nuclear power plant applications of advanced and emerging technologies from non-nuclear areas, such as advanced sensors, advanced control systems, artificial intelligence and robotics. These activities are funded within the Advanced Breeder Technology Program.

A1/18/4

ADVANCED NUCLEAR SYSTEMS PROGRAM

Question 18: The efforts within the Advanced Nuclear Systems program are presumably directed toward the development of the radioisotope thermoelectric generator (RTG) for space applications as well as other applications. In view of the fact that the RTG systems for the Galileo and the Ulysses (formerly the International Solar Polar Mission) spacecraft are essentially complete, what will be the future direction of the RTG program?

Answer: Several future space missions will require RTG's. For example, in 1983 the Solar System Exploration Committee (SSEC) of the NASA Advisory Council released a report that recommended the missions that NASA should support in the coming years. The SSEC recommended an initial sequence of four more missions: (1) Venus Radar Mapper; (2) Mars Geoscience/Climatology Orbiter; (3) Comet Rendezvous/Asteriod Flyby; and (4) Titan Probe/Radar Mapper (which may become the Saturn Orbiter Titan Probe).

The first two missions are currently funded by NASA and the third is planned as a new start in FY 1987, with the fourth following close behind. The significance of this is that, although there is no formal commitment for these missions, both the Comet Rendezvous/Asteriod Flyby and the Titan Probe/Radar Mapper missions will require RTGs.

Commensurate with the civilian space program forecasts, the military has indicated its intention to accelerate and emphasize consideration of space nuclear power systems for incorporation into future Department of Defense payloads.

Answer 18: (continued)

Increasing emphasis on nuclear and laser hardening, on-orbit maneuverability and reducing detection cross-section, enhance the viability of radioisotope thermoelectric generators and dynamic isotope systems in DOD future space missions. The Boost Surveillance and Tracking System (BSTS) and the Space Surveillance and Tracking System (SSTS) are two highly promising Air Force applications for isotope nuclear power systems.

In the special applications area, we understand that there will be a continuing need for unique RTG's for specialized DOD missions.

A1/19/3

ADVANCED NUCLEAR SYSTEMS PROGRAM

Question 19: It is my understanding that the $20 million allocated for Advanced Nuclear Systems essentially provides for the supply of flight qualified RTGs for the Galileo and Ulysses spacecraft only, while all or most of the funding for advanced technology developments on radioisotope thermoelectric generators has been eliminated. Please explain to me the rationale for the decision to eliminate advanced radioisotope heat source research at this time.

Answer: The FY 1986 funds available for the Advanced Nuclear Systems program are, as indicated, sufficient only to finance the activities related to the NASA Galileo and Ulysses missions, e.g., support production, acceptance testing, and delivery of flight RTG's; conduct safety testing, analyses and documentation; continue RTG life-testing to support performance analyses; and conduct technical support of the launch and missions. These are activities to which the Department had previously committed and are necessary for the safe conduct of the Galileo and Ulysses missions. Advanced radioisotope heat source research and development activities were eliminated not due to any decision that they were unnecessary or unimportant to the future of the program, but simply as a result of budget priorities, i.e., the Galileo and Ulysses activities will require the full $20 million in the budget.

ADVANCED NUCLEAR SYSTEMS PROGRAM

Question 20: This activity, that is, the development of RTG's and the application of these systems for space missions, has been part of the Department's program for more than 20 years. As such, I would suspect there is a very strong technology base to support advanced developments. Has the Department implemented or pursued any activities directed toward determining future applications for these systems? As an example, our staff has learned that the Air Force has identified potential needs for systems that can produce electrical powers comparable to those obtained from RTG's for some of their future applications. Has any attempt been made to establish a cooperative program with the Air Force to further the technology development of these systems?

Answer: The Department staff has worked closely with both the civilian and military agencies in their activities related to the use of RTG's in future space missions. Because of the Air Force's continuing interest in space isotope power systems, we have recently drafted a new memorandum of agreement between the Department and the DOD which would cover the general responsibilities of each organization in future space missions utilizing isotope power systems. We have also drafted a specific agreement, Supplemental Agreement Number 1 to the MOA, to cover the technology development of a Dynamic Isotope Power Subsystem (DIPS), which could have application on future Air Force missions. In addition, we have prepared a draft DIPS program plan which is currently under review by the Air Force. However, DOE funding for DIPS, as well as for continued development of the Modular Isotope Thermoelectric Generator, which might also be suitable for some Air Force requirements, is not included in the FY 1986 DOE budget due to budgetary limitations and priorities as previously described.

A1/21/3

ADVANCED NUCLEAR SYSTEMS

Question 21: Why is it that in a time of such severe budget restrictions that we can find funds to support activities, such as the water-cooled breeder reactor at levels totally incommensurate with their value to the overall nuclear fission program, while programs such as Advanced Nuclear Systems must suffer reductions that could irrevocably damage their implementation to future space missions?

Answer 21: We believe that the funds requested for the Water Cooled Breeder program are justified and useful to the overall nuclear fission program. The light water breeder concept being developed and proven in the Water Cooled Breeder program is an important nuclear energy alternative that has future potential in satisfying the nation's electrical energy requirements. The program is a successful development effort now within two years of completion. Our FY 1986 budget represents the Department's best judgement as to the needs of the Water Cooled Breeder and the Advanced Nuclear Systems programs.

A1/22/3

ADVANCED NUCLEAR SYSTEMS PROGRAM

Question 22: Could you please provide us your estimate of what minimum amount of funding would be required in order to sustain in FY 1986 a base advanced technology program in RTG research?

Answer: It is estimated that a minimum of approximately $6 million would be required to sustain the advanced technology program in RTG research in these four essential technical areas.

A1/23/3

DEFENSE NUCLEAR ENERGY PROGRAM

Question 23: The committee has been quite satisfied with the arrangements that have been initiated as a result of the February 1983 tri-agency agreement. It is also our understanding that the technology has moved significantly forward as a result of this arrangement. How will this tri-agency coordination be affected as a result of the significant management changes within the SP-100 program?

Answer: As you are aware, the Strategic Defense Initiative Organization (SDIO) recently assumed the DOD responsibilities in the ongoing tri-agency program. This occurred at the same time as the key DARPA and NASA representatives moved on to other positions, and therefore, as indicated, the potential existed for serious impacts on the tri-agency coordination. However, increased management attention and other steps were taken to assure that such impacts did not develop, and the tri-agency coordination has continued to be excellent. Permanent personnel have now been named in all three agencies, and planning for assignments in the next phase is well underway. Close inter-agency coordination will continue in the next phase, and in addition, each agency will be assigned more specific roles for particular elements of the program. For example, the SDIO will provide overall programmatic direction, whereas DOE will have responsibility for the Ground Engineering System test and NASA will pursue advanced aerospace technologies and analyses and definition of civil mission requirements. The responsibility for military mission analyses and requirements definition will be assigned by the SDIO to the Air Force.

DEFENSE NUCLEAR ENERGY PROGRAM

Question 24:	Are there any particular technology problems which will require additional research over the coming year, even after the SP-100 system concept has been selected?
Answer:	Efforts in the technology assessment phase of the program have been directed at identifying technical issues associated with the various concepts being considered and assessing the feasibility of resolving these issues. It has always been planned that much of the actual technical data to assure that the technical issues are resolved would not be fully in hand until results were available from the Phase II ground engineering system phase. Therefore, for whatever system is selected, there will definitely be areas of research that must be continued during FY 1986. The specific technical issues to be researched are different for each concept, e.g., lifetime of thermionic diodes in the thermionic concept, fuel and clad interactions in the reactor thermoelectric concept, and scaleability and reliability of the reactor Stirling concept.

DEFENSE NUCLEAR ENERGY PROGRAM

Question 25: Will there be sufficient funds in the FY 1986 budget to resolve any technology gaps or uncertainties in the SP-100 program?

Answer: We believe that through the combined FY 1986 funding requested through the three agencies, there will be sufficient funding to address the critical technical issues that need to be considered during the year. This is true, in part, because the contractor selection process is targeted towards a system contractor award in the May/June 1986 time period. Therefore, major funding needs for the system contractor begin in FY 1987 rather than FY 1986. This allows efforts on the key technical issues to continue in FY 1986 at the requested funding level, but will require overall funding increases in FY 1987 to provide for both the technical issues resolution and the system contractor efforts.

DEFENSE NUCLEAR ENERGY PROGRAM

Question 26:	Does the Department intend to support both the defense and civilian applications of space nuclear power, presuming that the defense applications will precede the civilian applications? If so, how will this be accomplished with the existing limitations in funding and personnel?
Answer:	Yes, the Department intends to meet the requirements of all civilian and military missions. For example, the SP-100 program has been carried forward as a tri-agency program in which both the potential civilian and military mission requirements have been considered. It is our intent to continue to structure the Ground Engineering System program in such a way that the technology would be applicable to both types of missions. However, we recognize that because of the potential nearer term application of the military missions, emphasis may need to be given to military requirements if the civilian and military requirements are not totally compatible. Nevertheless, we believe that such conflicts will be rare and that in most cases the civilian missions can build on the technologies and program structure established for the earlier military missions.

DEFENSE NUCLEAR ENERGY PROGRAM

Question 27:	Does the Department foresee any major impediments to assuring the availability of a space nuclear reactor power system for defense and civilian missions in the 1990 time period?
Answer:	Our current schedule supports the availability of a space nuclear reactor power system by the early to mid 1990's, but there are several key events that must occur if this schedule is to be maintained. These include completion of reactor design by around mid-1988 and initiation of endurance testing by mid-1990. With this schedule, it is our view that a flight commitment could be made by as early as 1988 or 1989. Unless such a commitment develops in that time period, having a flight system by the early 1990's will not be achieved. Similarly, if the funding support is not available to sustain the ongoing efforts, the program schedule will be extended. Our ability to meet additional mission requirements will depend, in part, on the degree to which space reactor and power source technology has been developed.

A1/28/3

LIQUID METAL REACTOR PROGRAM

Question 28: Several innovative ideas and initiatives are being explored by the Department for the nuclear fission R&D area. Is any attempt being made to involve the universities in these activities?

Answer: We are currently planning to expand university involvement in our innovative fission R&D activities. Preparations are underway to invite proposals from universities for innovative ideas and potential areas of research that will support our ongoing fission programs. Our FY 1986 budget request provides for significant university efforts and we look forward to an increased interest in nuclear fission R&D by the universities.

A1/29/3

LIQUID METAL REACTOR PROGRAM

Question 29: One of the stated goals of the Liquid Metal Reactor program proposed by the Administration is to preserve the future of nuclear power by supporting activity directed towards training the nuclear scientists and engineers of the future. In what ways specifically does the Department plan to support this goal?

Answer: The Liquid Metal Reactor (LMR) program plans to continue its support for training nuclear scientists and engineers for the future. For example, the nuclear science and engineering and health physics fellowship program will be continued with support from the LMR program. Also, new opportunities for supporting the training of nuclear scientists and engineers will be explored and promising approaches will be implemented as funding permits.

A1/30/3

LIQUID METAL REACTOR PROGRAM

Question 30: The Committee in its report accompanying its authorization bill of last year made certain recommendations regarding support of university activities in the Liquid Metal Reactor program. Is the Department planning on implementing any of these recommendations?

Answer: The Committee's report (House Report number 98-686) recommends university involvement in R&D planning and expresses concern about the level of support for Nuclear Fission R&D.

University involvement in the R&D planning already exists in the form of the Energy Research Advisory Board (ERAB) of DOE. ERAB is an outside board of distinguished individuals from all areas of science and technology in industry and universities. In recent years, ERAB has been particularly active in areas relating to nuclear power and has provided an excellent forum for assessing future DOE plans. Specifically, there is a current ERAB Panel on Light Water Reactor R&D that has just completed and will soon submit to the Secretary of Energy, a report recommending various future nuclear development programs. This report, and an earlier study of reactor safety, provide DOE with recommended priorities for reactor development. Our FY 1986 budget provides for expanded university involvement to obtain innovative ideas and associated research in support of the restructured program.

PROGRAM ADMINISTRATION AND SUPPORT

Question 31: In accordance with direction from the Appropriations Committee, the Department reduced their nuclear budget by $25 million. Although Appropriations called for a general reduction, it appears that the largest reductions took place in programs which, according to the FY 1986 budget, can bear these reductions the least. Could you please explain for the Subcommittee how priorities were set making these reductions? For example, why was the Light Water Breeder Reactor reduced only $330,000, whereas the Liquid Metal Breeder Reactor program was reduced $4.8 million, the High Temperature Gas-Cooled Reactor was reduced more than $2 million, and the Advanced Nuclear Systems program absorbed a $1.6 million reduction?

Answer: In FY 1985, $32.5 million of various reductions were made to the $615.2 million Nuclear Energy portion of the Energy Supply R&D budget. This was a reduction of 5.5% of our request and 4.5% from the conference report.

$5 million was a reduction directed by Congress in the Breeder R&D program. Congress also directed an additional $15 million general reduction in Nuclear R&D, a further reduction in ADP of $2.25 million and increased Management Initiative savings in the Energy Supply R&D account to $37.3 million, of which $10.5 million was allocated to the Nuclear programs. These reductions to nuclear programs total $32.5 million.

To achieve these reductions, we used our best judgment of what to cut with a careful eye to fairness and equity.

PROGRAM ADMINISTRATION AND SUPPORT

Answer 31: (continued)

Within the Converter program, the HTGR program was reduced by a total of 6.8% ($2.3 million) only because we chose to maintain the LOFT consortium at the internationally agreed upon funding level of $25 million with no reduction. During FY 1985, the LOFT program will complete its tests and can not undergo any reductions and still maintain their test schedule.

Among the various programs, we managed the reductions through cuts across the board so that no major milestones would be missed or increased costs face us in later years because of the reductions.

EPRI
Electric Power
Research Institute

March 15, 1985

The Honorable Marilyn Lloyd
Chairman, Subcommittee on Energy
Research and Production
Committee on Science and Technology
Room B-374, Rayburn House Office Building
Washington, D.C. 20515

Dear Chairman Lloyd:

Thank you for the opportunity to testify before your Subcommittee on February 21, 1985 on FY 1986 DOE programs for light water reactor development. In Attachment A you will find answers to the questions which were posed in your letter of February 27, 1985. The questions which you raised are important, so I am pleased for the opportunity of expressing my thoughts.

I hope that the information will be useful as a supplement to the record of the hearing.

Very truly yours,

Robert L Loftness for
Floyd L. Culler
President

FLC:kea

Enclosure: As stated

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ATTACHMENT A

To Letter to Chairman Marilyn Lloyd
House Subcommittee on Energy Research
and Production, March 15, 1985

The following are answers to questions from a letter of February 27, 1985, from Chairman Marilyn Lloyd to Mr. Floyd Culler, President of the Electric Power Research Institute.

QUESTION 1: If it is your perception that the Federal R&D program should sustain a major effort in technology related to the large integrated plants, then I think it would be of interest to the Subcommittee to have your expression of the utility support for such efforts. In other words, when and how would utilities come up with the up-front capital costs necessary to build such plants?

REPLY

I think that some Federal R&D support should be provided to sustain a significant effort related to large integrated LWR plants to supplement what will be done by the utilities and the nuclear suppliers. It is my opinion that LWR reactor designs which preserve the best features of the several hundred reactor systems now in use, and augments or changes them to advantage, is a prudent and necessary course. The only reactor systems that can be available for use in the 1990's will be those which do not require a large pilot or demonstration program to prove significantly new design concepts and to acquire necessary operating data to be licensed and to justify the investment risk.

This must not rule out careful detailed studies of the effect of reactor size on capital costs, the delivered costs of electric power, and the overall financial risk to the utilities. Thus, studies of reactors of lesser generating capacity than current BWR's and PWR's should be funded as part of DOE's Advanced LWR Program. Studies of this nature are already started by EPRI and the utilities, as well as DOE, and deserve significant support.

So, too, should some funding be devoted to truly advanced ideas, such as PIUS, or very small modular plants to explore their technical feasibility and possible costs, both capital and total costs for generating electricity. New or advanced light water reactors will have to compete with costs of power produced from clean burning coal systems (fluid beds, gasification combined cycles, pulverized coal boilers with scrubbers) in the capacity range of 200-500 Mw electric.

The electric utilities almost certainly will not build any newly authorized reactors until the open-ended economic risk, brought on primarily by the regulatory processes peculiar to the United States, are changed. The level of public safety most certainly should not be lowered, but it would not, because the technical assurance and requirements necessary to protect the owners' financial risk are greater than those required to protect the public. But no investment can be made prudently when the long delays caused by the process of regulation are possible, the uncertainty of when (or even if) a completed plant can go into production use. The regulatory uncertainty must be reduced.

Then, too, the uncertainty about future loads must be resolved. Because of population increases, the probability of a fluctuating but sustained growing economy in the U.S., and the slow substitution of electric power for other energy forms, additional power capacity will be required for certain regions of the country by the early 1990's. As long as uncertainties exist, particularly if we cannot resolve regulatory and load uncertainties, commitments will be made to relatively small, clean burning fossil units. But as demonstrated by the costs and performance of perhaps 70% of the reactors operating and coming on line in the U.S., and particularly with U.S. reactors built overseas, the least costly electricity is being generated by large central stations. It is anticipated that the economies of scale will remain. Our costs are high because our processes for approval drag construction to 10 to 14 years, whereas other countries build the same reactors, using U.S. forms, in less than five or six years.

When regulatory--federal, state and local--and load uncertainties are judged to be acceptable by the utilities and the investment community, and the ability to produce electricity at costs competitive with clean coal systems can be shown, raising the investment capital required for central station nuclear plants can certainly be accomplished. The same conditions for reduction of financial risk will go for a nuclear power station of any size.

Thus, DOE should, in my opinion, support development and research in three categories:

1. To improve operating reactors and those which are now being constructed. Examples: acquisition of data from TMI-2; specific support to experimental programs dealing with the source term as is now being proposed as supported currently. Beyond these activities, development which can be useful to any LWR reactor

should be supported: systems to correlate and explore simplification of design for earthquakes; new systems for maintenance; life extension and longevity; radiation reduction measures; measures to explore probable lifetime of operating reactors.

2. To evolve advanced designs using our experience with existing reactors as a base. The reactor suppliers are doing this now for their particular lines. But there are broader studies that should now be done to simplify, reduce costs, increase particular safety characteristics, standardize and prelicense. Smaller and modular plants must be studied. This effort has been initiated by the utilities through EPRI, and participation by the reactor suppliers is evident. In my opinion, this effort, to be partially accomplished over the next 5 or so years, is the most important of all advanced R&D effort and should be supported with some funding from DOE.

3. Truly advanced concept studies of new concepts. This role is appropriate for DOE and most certainly deserves support. But it should not be the only advanced effort, as I hope my arguments in the previous paragraphs have supported.

QUESTION 2: In view of the fact that the Department has initiated an innovative design activity with contractors that represents a significant change from prior year program direction towards large plant designs, what has been the response from the utility industry regarding this new approach towards reduced size and modularity in the nuclear steam supply system?

REPLY

I think that the utility industry supports the new initiatives which have been undertaken by DOE. I know that this is true for the nuclear group at EPRI. But there is concern that if this is the only major effort undertaken by DOE, that the real opportunity to consolidate and rationalize thirty years of experience into standardized, partially shop-fabricated, less costly, safer LWR's might not be realized.

QUESTION 3: Can we expect the electric power industry to participate in the LMR program as they have participated in the past, i.e., with personnel and financial contributions?

REPLY

I think that the electric power industry will participate with government in the liquid metal reactor program. But neither the utilities or the reactor suppliers can afford to carry the major 15 to 20 year effort that is necessary to produce a mature LMR reactor. The utilities will continue support at several millions of dollars per year through EPRI. But, in my opinion, it is unlikely that the regulated utilities could fund major efforts, particularly the construction of a demonstration project. As in other nations who carry on with major long-range reactor work, in particular with the liquid metal reactor, the responsibility for development and demonstration must rest with the federal government. No element of the private sector has a means to recover the costs of investments required before real offsetting income can be produced from breeder use, probably some twenty years from now. Certainly the regulated electric utilities cannot under currently prevailing conditions.

* * * * * * * *

WestinghouseHanford P.O. BOX 1970 RICHLAND, WA 99352

March 11, 1985

The Honorable Marilyn Lloyd, Chairman
Subcommittee on Energy Research
  and Production
Committee on Science and Technology
U. S. House of Representatives
Washington, D. C.   20515

Dear Representative Lloyd:

Your letter of February 27, 1985 provided additional questions seeking information which would be used to supplement the hearing records. Attached are my responses to those questions.

I am pleased to be able to provide this added information and hope it will be of value to your subcommittee.

Sincerely yours,

John E. Nolan

John E. Nolan, President

Attachment

Q. The Administration's proposed FY 1986 Liquid Metal Reactor program has undergone significant redirection. Please explain for the Subcommittee the specific programs at your Laboratories that have changed and the reasons for these changes.

A. The redirected Liquid Metal Reactor Program for FY 1986 will significantly change the scope of program elements to be conducted at the Hanford Engineering Development Laboratory (HEDL). Specifically, BRET is being deferred, basic research and development in Physics, Reactor Safety, Structural Analysis, Materials Development, Sodium Technology and Advanced Systems and Controls Instrumentation will be all but eliminated and development of reactor fuels and materials is being narrowed to support the Core Demonstration Experiment (3 year core) only. Operation of the Fast Flux Test Facility, conduct of the Core Demonstration Experiment and startup of the Secure Automated Fuel Fabrication Line will all experience significant slippage in major program milestones.

I believe that DOE's restructured program demands the kind of research and development that is being affected. However in light of the Administration desire to reduce federal spending and the deficit growth rate, the Department has prioritized the program elements and allocated the limited funding accordingly.

Q. Continuing along the lines of the innovative design-related work, are the laboratories making greater efforts to support industry in their design development efforts through offering or utilizing facilities at the laboratories to help resolve certain technical issues that may arise in this first phase of the design effort?

A. The Hanford Engineering Development Laboratory (HEDL) is the DOE site at which scientific concepts and laboratory observations are transformed into physical reality through effective and innovative application of sound engineering practices. This has resulted in an outstanding record of achievements and the recognition of HEDL as the laboratory which can rise to the challenge of complex engineering problems and deliver a practical and workable product. Laboratory staff members have a long history of effective interactions with and support to the U.S. nuclear industry. A comprehensive program of technology transfer to the industry was in place at HEDL for many years before the issue was elevated to its present level of emphasis. Technical staff members of the organizations involved in the innovative reactor design competition have been closely affiliated with ongoing HEDL programs for years. The innovative designs which are emerging will thus be highly dependent on the technology which has been developed at HEDL and dependent on the successful conclusion of development activities currently underway. The mere fact that the innovative designs are not dependent on technical breakthroughs yet to come, but only on the confirmation of design features through existing program activities, without a need to redirect these activities, is a measure of the relevance of the HEDL programs.

A recent series of meetings with key technical representatives of the General Electric and Rockwell International design teams resulted in reaffirmation of the importance of the LMR program activities at HEDL and broad endorsement of the ongoing efforts. In a concerted effort to provide even more direct support to the innovative plant designers during the initial phase of the design study, a total of 28 specific tasks have already been defined in which HEDL will furnish near-term assistance to GE and RI. These tasks cover a broad spectrum of activities, including discrete experiments in FFTF, work on a long-life fuel system and other long-life core components throught the Core Demonstration Experiment, fuel cycle plant design and analysis, structural and seismic design, FFTF plant operations experience (fuel handling, core physics, coolant technology, plant components, etc.), inherent safety concepts and methodology, and many others.

I am pleased to assure you that the staff of Westinghouse Hanford Company is fully committed to support of the DOE innovative design studies. In the short period since awarding of the design contracts, we have observed an increased level of interest in the design community in the development programs at HEDL, and view this as an important trend in itself. We will continue to exert every effort to remain fully responsive to the technical requirements of the innovative designer groups and to operate the Hanford Engineering Development Laboratory in a manner supportive to those needs and those of the DOE Civilian Reactor Development Program.

Q. The BRET program has been essentially terminated in FY 1986. This must have certainly had a negative impact on some of the activities at HEDL. What precisely has been the impact of the proposed FY 1986 budget on your oxide fuel research program?

A. The BRET program was effectively placed on hold in FY 1985 because funding in that fiscal year was confined to a limited amount of FY 1984 carryover funding. This has permitted us to retain a small cadre of individuals with key skills in remote handling technology and reprocessing systems/processes design. Other experts in this technology have been reassigned to various other activities in the Laboratory, enabling the retention of Laboratory skills in BRET-related areas. The proposed FY 1986 budget for HEDL will necessarily force a further erosion of this capability. The use of space in the FMEF for alternate missions is being evaluated, but without compromising the ability to use the FMEF for a future reprocessing mission.

The proposed FY 1986 budget has a major impact on the oxide fuel research program at HEDL and at other DOE and industrial laboratories. The HEDL portion of the research program, which represents the major element of the DOE program for LMR oxide fuel R&D, would be required to operate at approximately 25% of the fiscal year 1983 funding level, suffering a reduction of about 65% from the FY 1985 level. This comes at a time when the FFTF irradiation testing program would be reaching a peak level of output, and our ability to continue with a dynamic research program on fuels and materials performance would preserve the world leadership position of the U.S. in this vitally important technology. This leadership will ensure a substantive U.S. position in international matters concerning plutonium-bearing fuels and fast breeder reactors. The proposed FY 1986 funding would impose a highly-visible retrenchment of the U.S. program and lead to a perception that the U.S. is abdicating its leadership in core systems technology. In fact, that would be the case, as we would be reduced to a maintenance-level effort on the primary fuels and materials program initiative, the Core Demonstration Experiment, for establishment of a long-lifetime core system. The funding level proposed may be sufficient to permit the continuation of that experiment to its goal of several-fold increase in fuel lifetime capabilities; at issue is the ability to carry out the necessary supporting R&D activities required for performance and safety analyses which are required in order to carry the experiment to completion.

Q. In view of the reductions in the Nuclear Fuel Cycle program, what will be the direction for the Secure Automated Fuel Fabrication Program?

A. A reduction in the Nuclear Fuel Cycle program budget will not affect the direction of the Secure Automated Fuel Fabrication (SAF) program, which is funded as part of the Advanced Reactors Program. The objectives of SAF can be accomplished apart from Fuel Cycle Program activities in reprocessing and waste treatment. However, closure of the fuel cycle has been a long standing goal which can be accomplished in the FMEF on a scale appropriate to domestic and foreign initiatives.

Q. What is the role of the SAF line activity within the new direction of the Liquid Metal Reactor Program in FY 1986?

A. The SAF Program provides vital support to the overall FY-86 LMR Program. During 1986, the SAF Program will focus on completion of installation and startup of the Secure Automated Fuel Fabrication Line. This objective supports several major LMR Program initiatives including: (1) providing fuel for operation of the FFTF including support of the Core Demonstration Experiment, (2) forms the fabrication plant design basis for the Innovative Reactor Design Program, (3) provides near-term opportunities for meaningful international collaboration (e.g., MONJU fuel fabrication proposal), and (4) demonstration of improved technologies for responsible handling and safeguarding of plutonium. Successful completion and operation of the SAF Line keeps the U.S. in a world leadership position in mixed-oxide fuel fabrication, as well as maintaining leadership in highly reliable fuel performance.

Q. As you indicate in your testimony, your laboratory has the lead responsibility for mixed oxide fuel fabrication technology. Do you believe that the mixed oxide fuel technology alone maintains U.S. leadership in advanced fuel fabrication activities? Do we substantially compromise our leadership role if we rely solely on mixed oxide fuels?

A. The world focus is on oxide fuels, and it is thus appropriate that the U.S. assert its leadership within the scope of that technology. It would be a disservice to the interests of world security if the U.S. were to diminish in any way its strong emphasis on fabrication and performance of mixed oxide fuels. Of the world fast reactors which have become operational in the last twenty years, and those planned for the next ten to twenty years, all except one utilize oxide fuel. This includes reactors in France, Germany, the United Kingdom, Japan, the Soviet Union, and the United States. The lone exception is a small (15 MWe) test reactor, the FBTR, now being completed at Kalpakkam, India, which will utilize mixed uranium-plutonium carbide fuel.

For many years, the U.S., U.K., U.S.S.R, France, and others have conducted research programs with a variety of fuel types (oxide, carbide, nitride, metal, inorganic salts, etc.). A number of fuel cycle variations were explored in the period of the INFE (International Nuclear Fuel Cycle Evaluation) studies. This broad spectrum of fuel research was possible because U.S. had no commitment to a particular reactor or fuel cycle. Other countries, however, have made such commitments: the fuel cycle of choice in France, Germany, Japan, the United Kingdom and the Soviet Union is the oxide cycle, and those countries have made substantial capital investments in this fuel cycle. It is inconceivable that the U.S. could do anything to change foreign commitments to oxide fuel, even if it were appropriate to do so, and of course we do not believe this to be the case. Fuel cycle plants in other countries have emulated U.S.-developed processes and methods and are currently actively seeking to share in the advanced technology we have developed, particularly in the area of fuel fabrication. The U.S. is now setting the standards for future fabrication plants which will afford appropriate security measures against plutonium diversion, real-time accountability and necessary safeguards, and protection of workers, as well as reduced costs and improved product quality. If the rest of the world is not stimulated by the U.S. competition to upgrade the technology of mixed oxide fuel fabrication plants, the world will face increased risk of proliferation.

The U.S. leadership role is not substantially compromised if we rely solely on mixed oxide fuels. Nevertheless, we are presently testing advanced carbide fuel assemblies in FFTF and will soon introduce a full-size metal fuel assembly in the core. The world has essentially made the decision for oxide fuel, and we çannot function in isolation and expect to be unaffected by foreign developments.

Q. In your judgment, what do you perceive as the driving issues that will determine the marketability of small, passively safe and low-cost liquid metal reactors?

A. In my opinion the "driving issues" are proof that the plants:

. are truly passively safe,
. are licensable,
. can be built and operated for the stated cost,
. can achieve an economic return,
. are needed for generating capacity.

Q. From Industry's perspective, at what point do you believe the Federal government support for development of these innovative designs will no longer be necessary? That is, at what point do you believe the industry will be able to pick up the task of marketing and completing the design and development of such reactors without substantive Federal support?

A. I am the Director of a National Laboratory and cannot speak for industry. However, as a personal opinion I would say that Federal government support for development of innovative designs will be necessary until there is a seller and a buyer. There will be a seller when he has confidence that what he is selling can be built and operated for the cost that he is proposing and he believes that the plant will perform and meet all the performance specifications that he warranties. There will be a buyer when he needs what the seller is selling and when the buyer has confidence that the plant will perform as required and can be built and operated for the costs identified. The costs to complete research, development, testing, and necessary demonstration to reach those confidence levels are beyond the capabilities of the private sector.

I believe the government-industry partnership in LMR development should continue to go forward until confidence in a revitalized and growing nuclear energy system has been developed, reliable and economic LMR construction and operation have been established, LMR design and licensing criteria are well defined, and an accepted program is in place for closure of the fuel cycle.

Although history and experience emphasize the uncertainty of forecasts, a government-industry partnership in LMR development will probably be necessary on into the next century.

Q. What will be the role of the FFTF operations within the context of the new program direction?

A. FFTF's role takes on added importance in the new restructured program. Without plans for a demonstration plant, the FFTF is the only U.S. facility with capability to test full size advanced core designs, demonstrate advanced plant technology and accumulate the LMR plant experience necessary to complete development and transfer of LMR technology to industry.

In support of advanced core design testing, we are currently irradiating forty-two full-size test assemblies. These tests are establishing the behavior of advanced fuel and control element designs at conditions planned for advanced LMRs. Tests currently in the FFTF core include the lead assemblies for the Core Demonstration Experiment (CDE). This experiment will demonstrate the viability of fuel assemblies with nearly triple the in-core residence time of the current fuel system - - an obvious economic gain for future LMRs. Simultaneously, using the Materials Open Test Assembly (MOTA), we are irradiating a wide variety of alloys that have the potential to provide even longer residence times. The FFTF is the only plant with a test volume large enough to support testing of these prototypic sized core components and with the instrumentation and controls to conduct these complex materials tests under a wide range of temperature and flux levels.

Examples of FFTF's role in the development of advanced plant technology include support of man-machine interface improvements and development of automated reasoning and procedure prompting systems. Other examples include confirmation of high temperature stress analyses, advancement of sodium technology, reduction of seismic requirements and simplification of plant design. These developments are on the leading edge of nuclear plant technology.

FFTF plant experience contributions include plant reliability demonstration and international collaboration. In 1986, FFTF will demonstrate reactor internals performance through more than 1000 full power days of operation and verify performance of large plant components, LMR vessels and piping systems, and safety related systems through eight years of operation. From an international standpoint, we are conducting irradiation tests for the Japanese, British, Germans, and French and supporting international technical exchange programs.

The overall plant experience we gain from operating FFTF, coupled with our advancements in fuels and materials technology, will provide the base required for substantive international collaboration and technology exchange.

Q. Could you explain for the Subcommitte how the work at the FFTF supports the Department's redirection of the Liquid Metal Reactor program towards innovative reactor designs?

A. All the work on-going at FFTF directly supports the innovative designer activities. The FFTF reactor core and plant systems performance data are being routinely transmitted to the designers for confirmation and evaluation of their specific unique concepts. Core systems designs developed at WHC and now under test in FFTF will form the basis for the long life fuel designs which the innovative designers are applying directly to their plants.

Also, inherent safety features are being developed in collaboration with the reactor designers and will be tested at FFTF starting this year. These features include core designs which allow passive neutronic shutdown and follow-on passive decay heat removal. These feature tests are essential to development of reactors that will automatically revert to a safe condition when operating parameters are exceeded with no mechanical, electrical, or human intervention.

In addition, the innovative designers are, of necessity, developing unique, but untried systems in artificial intelligence, man-machine interface and safety systems concepts to drive costs down while maintaining licensability. The testing capabilities and highly trained staff of operators, engineers and craftsmen at FFTF permit these untried designs to be tested in a real plant environment. This is vital to gaining public utility acceptance of these innovative designs.

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DR BERTRAM WOLFE
VICE PRESIDENT AND GENERAL MANAGER
NUCLEAR TECHNOLOGIES & FUEL DIVISION

March 5, 1985

The Honorable Marilyn Lloyd, Chairman
Energy Research and Production Subcommittee
House Science and Technology Committee
Washington, D.C. 10515

Attn: Ms. Debbie Johnson
B-374 Rayburn House Bldg.
Washington, D.C. 10515

Dear Madam Chairman:

I appreciate the opportunity to supplement the record of hearings with responses to questions included with your letter of February 27, 1985. I know you realize the answers to these questions are strongly influenced in general by the current low level of orders for new generation and, in particular, by the current nuclear hiatus and uncertainty. Changes in this environment could alter our perceptions but as of today we do not see when or what will effect this change.

> Has there been any foreign expressions
> of interest in the innovative (reactor)
> design concepts that you are developing?

Yes, there have been a number of foreign expressions of interest. The stronger of these have been from various utility and manufacturing organizations in Japan, while a modest level of interest has also been expressed from Europe. These expressions of interest relate primarily to LMRs, particularly in Japan with its aggressive breeder program, especially if there is a potentialk for capital cost reduction.

General Electric encourages these expressions of interest, and has responded to them, because of the potential for foreign involvement in the technology and safety testing programs which will be needed to bring either the HTGR or LMR advanced reactor concepts to the market. In addition, the innovative design concepts become potential items for technology exchange programs with overseas partners at both the national (i.e., government) and private (i.e., contractor) levels.

In your judgment, what do you perceive as the driving issues that will determine the marketability of small, passively safe and low-cost liquid metal reactors?

The driving issues that will determine the marketability of small, passively safe and low-cost liquid metal reactors are similar, if not identical, to those issues that will determine the marketability of any future nuclear system. In general, nuclear's marketability in the United States will be determined when we have demonstrated that nuclear plant schedules and costs are predictable and acceptable. To be acceptable, schedules must be within the utility's reasonable planning cycle which is probably less than ten years and probably closer to five years. Costs must be competitive with alternatives such as coal and should provide new capacity without excessive rate increases.

We do not believe there is a significant market for small nuclear plants in the United States. While there is a major advantage initially to limiting the utility's investment commitment with small capacity levels, we believe any nuclear site would eventually grow to gigawatt size levels. If this growth can rapidly and economically be added when determined necessary, the small or modular approach would be particularly attractive. Therefore, our approach has been directed to large plants that can be economically started up with relatively small capacity levels but can be expanded with growth in demand.

Possibly the one unique feature of the liquid metal reactor is its fuel cost stability. while fuel costs are not an issue today, should we solve the high plant cost of nuclear, fuel costs would ultimately become an issue with converter reactors. Therefore, if the capital cost of liquid metal reactors can be proved to be preditable and acceptable and the fuel cycle is closed and proven to be economic, the liquid metal reactor could be competitive in the intermediate and longer term.

From industry's perspective, at what point do you believe the Federal government support for development of these innovative designs will no longer be necessary? That is, at what point do you believe the industry will be able to pick up the task of marketing and completing the design and development of such reactors without substantive Federal support.

There are two elements involved. First, of course, the development work must be carried to the point where design details and the technical aspects have been demonstrated such that the key features of the design have been proven sound. This determination can vary from demonstration of passive safety systems for a commercial LWR plant to full scale safety tests of advanced reactor systems. As mentioned in my testimony the demonstration should result in a reduction in the need for regulatory review and overview and the assurance that the new design and construction practices and procedures can yield quality products with competitive and predictable economics. But even beyond this I believe that Federal leadership and support may be required in order to demonstrate the stability of Federal policies and regulatory approaches, and the consistency of the design approach with such policies and procedures. In other words, we have both technical and institutional hurdles to overcome. Government help and support in both areas will be necessary.

Thank you for this opportunity. I trust the above will be helpful in formulating plans for reactors and the intermediate term.

Sincerely,

B Wolfe

Bertram Wolfe

BW:e

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JPL

6 March 1985

Committee on Science and Technology
Subcommittee Office
Attn: Ms. Debbie Johnson
B-374 Raybourn House Office Building
Washington, D.C. 20515

Dear Ms. Johnson:

Enclosed is the response to questions recently sent to me by Congresswoman Lloyd regarding testimony which I gave on February 21, 1985 to the Subcommittee on Energy Research and Production.

Sincerely,

Vincent Truscello

Vincent C. Truscello
SP-100 Project Manager

Response to Questions from HS&T
Re: Truscello Testimony

1. The selection of a design concept is expected in July of this year. Is that correct, or is there a strong possibility that the schedule will slip?

   It is our expectation that we will have sufficient data by July to make an informed decision.

2. Are there any particular technology problems which will require additional research over the coming year, even after the system concept has been selected?

   It is likely the system selected would have residual uncertainty associated with it. We deal with that uncertainty by being conservative with regard to a specific design parameter (such as operating temperature, amount of fuel burnup, allowable degradation, etc.). Additional research over the coming year will allow us to more fully understand that uncertainty and to potentially remove some of the conservatism introduced into the design leading to the development of a higher performing system.

3. In selecting the design concept for the SP-100 Program, I understand that a design selection committee was formed. How is this committee constituted? Are there potential system users involved in the selection of the design which is to be further developed into a ground engineering system?

   At present the members of this committee are from the Laboratories performing the detailed audit of the system contractor design (JPL, Los Alamos, and LeRC). In general the members are the top level managers of the various activity areas and through which the detailed specialists report. The preferences of the potential users are formally introduced in this process through the selection criteria.

   These criteria are based on a design and requirements document that was evolved over the past two years through interactions with the user community (both military and civilian). The selection team will compare the design and technology data base against the criteria and will select that system that best satisfies the criteria.

   Currently we are considering the addition of another member to the selection committee representing the near term potential user (military person).

4. What is your assessment of the working relationship among the three agencies participating in the SP-100 program?

   The relationship is excellent and effective. In February a steering committee meeting was held. The tenor of the meeting was positive and quite upbeat. At the meeting the Phase II management structure was discussed and agreed to by all concerned. Currently a memorandum of agreement is being developed for phase II.

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March 7, 1985

Marilyn Lloyd, Chairman
Subcommittee on Energy
Research and Production
U.S. House of Representatives
Committee on Science and Technology
Suite 2321 Rayburn House Office Building
Washington, D.C. 20515

Dear Madam Chairman:

I very much appreciated the opportunity to testify before your Subcommittee on February 21, 1985. I enclose answers to the supplemental questions you sent me in your letter, dated February 27, 1985.

I hope the answers provide you with the information you wish. If I can clarify any points further, I would certainly be pleased to do so.

Sincerely

C. E. Till
Associate Laboratory Director
Reactor Research and Development

CET:vag
Enclosure

1. The Administration's proposed FY 1986 Liquid Metal Reactor program has undergone significant redirection. Please explain for the Subcommittee the specific programs at your laboratories that have changed and the reasons for these changes.

As a result of Congressional urging, as well as the obvious need to rethink and refocus the breeder development program in the wake of the Clinch River termination, the DOE LMR program has undergone significant redirection. Although the directions implicit in the FY 1986 budget are not simply laid out, three main lines seem to be present. First is the division of the program into two categories, Advanced Converter Technology and Advanced Breeder Technology, second is the stated objective of developing new and innovative LMR concepts, and third is the stated objective of increased Internationalization.

The use of the Advanced Converter category does emphasize that the LMR can be near-term, but as I stated in my testimony, I do not think that the actual program contained in the FY 1986 budget supports the stated objectives in fact. The program supports facility operation. It supports design studies at a relatively low level at GE, Rockwell, and CoMO. And it cuts technology development, R&D capability, and IFR concept development to ribbons.

I am concerned about the variety of goals the program apparently has, particularly under constrained budgetary circumstances. A successful program cannot have such diverse goals, and it cannot succeed without hard technology development. The very simply-articulated objective of developing an attractive LMR concept and bringing it to an early proven status is obviously the objective of first-order importance. I believe enough is now known of the characteristics that a new attractive system must have, and enough is also known to focus the R&D to provide a system with such characteristics relatively quickly and inexpensively. I believe the program should be focused on this obvious goal.

We at Argonne have sharply reoriented our program over the past year toward this single goal. We have moved rapidly to define a generic concept with promise, in the IFR, and to set up the spectrum of R&D and test programs required to prove its feasibility, and we are proceeding across-the-board toward the focused goal of establishing feasibility by the end of FY 1986. As a separate but related effort, we have thrown large parts of our design and analyses capability into the industrial designs of GE and Rockwell to make them as successful, sound, and attractive as our efforts can make them, whether or not they are based on the IFR concept option. And we are refocusing our facility programs accordingly. We maintain a vital component of generic LMR technology development to provide us with the needed tools, but it is small now compared to the focused work on new concepts and designs.

We believe that a much improved LMR system is within our grasp and we are backing this judgment by action.

We also believe that these kinds of programs are the only really practical basis for International agreements. Only if the U.S. has forefront technology to bring to the table will the foreign programs enter into meaningful agreements with us that adequately benefit the U.S. I do not believe that offering our facilities per se in the end will accomplish much. On the other hand, if the U.S. is developing a potentially superior breeder technology, we will be correctly perceived as bringing a lot to the table. We therefore believe that both the objectives of developing a breeder option that has the right characteristics to make it practical in the U.S., and that of establishing an International position that makes real exchange with other programs truly feasible, are best served by setting the program goal as simply as I stated, focusing the program on it as we have done, and are doing, and moving as rapidly as we can to realize the goal. Only in this way, I believe, can we be successful.

2. **Continuing along the lines of the innovative design-related work, are the laboratories making greater efforts to support industry in their design development efforts through offering or utilizing facilities at the laboratories to help resolve certain technical issues that may arise in this first phase of the design effort?**

The ANL technology program is deeply involved in support of the development of the industrial innovative designs -- the General Electric PRISM project and the Rockwell International SAFR project. The Argonne National Laboratory involvement in these projects is of a rather unique kind within the national laboratory system and is simply due to the breadth of Argonne capability in nuclear systems technology. Argonne is both an active participant in the design development, and a source of feature development and testing for the new features of the designs.

Much of the starting design for the SAFR primary system resulted from a joint collaborative effort between Rockwell International and ANL in the previous years. The collaboration on SAFR is continuing, including ANL design support for the following areas: reference core design development for both oxide and metal fuel, reactor thermal-hydraulics analysis, plant transient analysis, safety analyses evaluating design basis accidents, risk assessments, and fuel cycle facility design including flowsheets, equipment lists, facility layout and cost estimates.

Support for the PRISM project is being arranged to be of similar magnitude and importance. ANL will be responsible for the design support in the following areas: refueling and services system development, reactor structural support arrangement, reactor coolant flow path optimization, risk assessment support, inherent safety evaluations, integral fuel cycle facility design, etc. To provide an IFR option to PRISM, core design studies will develop a metal core optimized for the smaller size PRISM module. The metal core should provide additional advantages for smaller modules because of the reduced control requirement associated with the burnup swing and the flexibility associated with the on-site integral fuel cycle.

The Argonne design and development activities are essential to these concepts, and are possible because of the unique ANL capability across the spectrum of reactor technology. Later, as innovative design concepts and features start to firm up, ANL will provide the necessary development and testing capabilities for key feasibility features such as, for example, air-side testing and materials development of the reactor vessel cooling system, electromagnetic pump high temperature insulation development/testing, thermal hydraulics validation of new configurations, steam generator booster tube concepts, and other innovative features. Without technology development and analyses capabilities of these kinds, these concepts and any other new reactor designs will remain paper designs only.

3. **I know that you have been proposing implemenation of the integrated fast reactor concept, but also as a part of your responsibilities at INEL were included efforts to support the advanced breeder reactor technology program. What particular effect will the FY 1986 budget have on your ability to continue this support?**

It is, of course, one of our responsibilities to support the advanced breeder reactor technology program. It is not possible to easily separate the part of this responsibility that is satisfied through the INEL (Argonne-West) test facilities from that which is satisfied from the parallel research and development, largely performed in Illinois (Argonne-East), and which drives the use of the test facilities. If the R&D is not performed at a reasonable level, the test facilities soon become meaningless.

Argonne's major test facilities located on the Idaho National Engineering Laboratory (INEL) site are a complete set of facilities that provide all the necessary capability for testing of nuclear systems technology for advanced liquid metal cooled reactors. EBR-II, a complete prototype LMR power plant, provides the test environment for fuels development, whole-system operational tests, and experience in liquid metal cooled reactor operation. TREAT, a specially design transient reactor, simulates LMR accident situations, and provides the necessary capability to test various facets of the safety performance of new reactors. ZPPR, a low power critical experiment facility, mocks-up the complete core of new reactor designs. HFEF, a hot fuel examination facility, allows the examination of highly radioactive fuels and materials experiments from TREAT and EBR-II, as well as FFTF, and provides the capability for collecting the required data from the experiments. Taken together, they satisfy the facility needs for establishing the nuclear system performance of any new sodium cooled reactor design. These facilities are not only key to the demonstration of new concepts but they also support generic advanced LMR technology development.

The FY 1986 budget allows the continuation of the ANL-W facilities operation. This may give the impression that the efforts to support the advanced LMR technology development will continue. However, since the proposed FY 1986 budget will largely eliminate the R&D necessary for meaningful operation of the test facilities, our ability to support advanced breeder reactor technology through the facilities will correspondingly be reduced to an insignificant level under that budget.

4. In your testimony, you state that the proposed FY 1986 funding for Argonne-East would provide only $9 million for LMR work. This figure differs from the Department's estimate of about $13.3 million in OE for ANL-East. How do you account for this difference?

In early January the Laboratory received unofficial planning guidance from the Department of Energy that the FY 1986 BA for the Argonne LMR program would be $53.1M total, $44.0M to Facilities (practically all of which are at Argonne-West in Idaho) and $9.1M for Technology (the basic R&D, practically all at Argonne-East in Illinois). The total of about $53M is borne out in the tables accompanying the DOE budget, although the State and Laboratory tables do not agree precisely.

This was the information given to the Laboratory by DOE at the time of the Subcommittee hearing and was the basis for the numbers quoted in my testimony. In the last day or two I have been advised by DOE, still informally, that there have been slight revisions to the earlier numbers. The total remains the same, (now $53.2M instead of $53.1M). The Facililties are now at $39.9M and the Technology at $13.3M. The latter, of course, is the number given to you by the Department.

It is obvious that this does not change the overall picture in any material way. Technology development at Argonne, including IFR technology development, is cut from $29.1M in FY 1985 to $13.3M in FY 1986 much of which would have to be spent in closeout costs. The IFR is not budgeted for at all. It was supported at $10M in FY 1985 and requires $15M in Operating funds in FY 1986 to complete the feasibility demonstration. ZPPR, which is required for any new concept, including the IFR, is to be shut down. It is allotted $0.8M in FY 1986, versus $3.5M in FY 1985.

The main points that I made in my testimony unfortunately still hold. The only way any truly new LMR concept or specific design, can be made real is through real and actual advances in the technology. This budget dismantles the only remaining capability in Nuclear Systems Technology development, shuts down the only remaining critical facility in the U.S. to prove out the neutronics of innovative reactor core configurations, and terminates the development of the only truly new and promising advanced LMR concept in the zeroing out of the IFR. It as much as assures that, apart from improvements in oxide fuel burnup, LMR technology will be frozen where it is. This is a pity, given the expenditures on the LMFBR, the real promise it holds, and the opportunity that the Congressionally-mandated restructuring of the program could have given and could still give to relatively quickly develop a much improved LMR system with much more desirable characteristics than the present system.

5. **Certain activities at the Idaho facility are expected to terminate this year. This includes the LOFT program and other programs that were funded specifically by the NRC for safety research. Has there been an effort to review the applicability of these facilities to programs within the redirected Liquid Metal Reactor program or other nuclear fission R&D activities proposed for the FY 1986 budget?**

I can most appropriately address this question in the context of the LMR, although I know that the suitability of the facilities in question, LOFT and PBF, are also being examined in connection with the LWR program and space related nuclear projects. They are undoubtedly being found to be of potential value in those programs. The issue is, of course, one of cost-effectiveness in the current climate. To my knowledge, LOFT has never been seriously considered for the LMR program and rightly so - there is no LMR need for which LOFT would be a suitable facility. At various times, perhaps most thoroughly in the mid-1970s as part of the SAREF program, PBF has been studied extensively for applicability to the fast reactor program. The conclusion reached was that, although PBF could be useful in studying some fast reactor safety phenomena (i.e., the effect of preconditioning - annealing of shutdown cracks by steady state operation - prior to severe transients), the value was marginal and not cost-effective. We have recently reassessed PBF, with particular emphasis on comparison with TREAT and reach the same conclusion relative to the LMR program even more firmly than before, both because of decreased interest in the phenomena PBF could address and a far more stringent attitude these days on cost-effectiveness.

6. Could you please explain for the Subcommittee how the work at the EBR-II is being used in support of the new initiatives in LMR design?

EBR-II directly supports the new innovative designs in four distinct categories. In each, EBR-II provides unique capability, not available in any other U.S. facilities.

First, EBR-II is both versatile and economic as a fuels test facility. It offers a wide range of both instrumented and open core test vehicles for a very wide variety of test conditions. This provides a capability unique in the world to perform experiments with failed fuel element (run-beyond-cladding-breach programs) and transient testing (duty cycle operation or plant protection system terminated transients). Because EBR-II is the only facility that can perform these tests, the Japanese PNC provides joint funding for them. The data on the operation with breached fuel is one key to achieving reliable and economic core designs, especially for hermetically sealed small module reactors of the kind now being proposed.

Secondly, the versatility of EBR-II also provides unique capability to perform plant transient tests to demonstrate inherent safety characteristics of the LMR plant. A series of unprotected loss-of-flow tests (without scram) will be initiated in the latter part of FY 1985. Inherent passive safety is given a high priority in the innovative LMR designs, and the EBR-II tests are essential to demonstrate these characteristics and validate the design tools. The shutdown heat removal tests in EBR-II will also provide the actual plant transient data, which will verify and improve the core and whole-plant thermal-hydraulic and system transient computer codes needed for design analyses. These severe transient tests are possible only in EBR-II because of its favorable reactivity feedback coefficients.

Thirdly, EBR-II is a complete power plant with steam generators and a turbine plant, and as such it provides a unique test bed for innovative plant components testing. Tests are being planned in support of the innovative design features which include steam generator leak detectors, flexible piping joints, use of advanced structural material (modified 9 Cr - 1 Mo) in the secondary sodium system, testing of self-actuated shutdown system features, development/testing of advanced instrumentation and control systems, etc. These tests will demonstrate the performance of innovative designs under actual plant operating environments.

Finally, the 20 years of very successful EBR-II operation provides the data on long-term irradiation effects on reactor structural materials, maintainability of sodium components, etc. that apply directly to the advanced designs. EBR-II is particularly pertinent because the pool design has now been adopted in all industrial innovative designs. The pool design concept originated with EBR-II, and many of the other innovative features being considered in the new advanced designs, such as in-vessel storage, EM pump, double-wall steam generator, passive reactor vessel cooling system, etc., were designed into EBR-II and are in place and providing operating data.

7. Your testimony provides the Subcommittee with some excellent information on development of metal fuels and the Integral Fast Reactor, the IFR. However, given the success and acceptance of the mixed oxide fuels and our limited budget resources, can we justify new expenditures on metal fuels and the IFR program?

This question gets to the heart of the case for the IFR. Mixed oxide fuel has certainly shown that it is a success and accepted insofar as its behavior inside the reactor is concerned; i.e., it provides satisfactory burnup, minimum fuel failures, and suitable safety margins. However, when the full implications of oxide fuel are considered, it leads to a system of unacceptable cost and without sufficient deployment flexibility. The essential IFR features of metal fuel, pyro and electro-reprocessing, and injection cast refabrication lead to a fuel cycle that is much simpler and less expensive than that for mixed oxide. It is these reduced capital and operating costs, as well as the reduced capital costs that can be achieved as a result of the improved passive safety of the metal fuel that largely provide the IFR advantages. Deployment flexibility comes from the diversion resistance of the IFR fuel cycle and its ability to be economically scaled all the way from small to large throughputs, in contrast to the oxide fuel cycle which can approach economic competitiveness only in large size handling many reactor plants. We conclude that the oxide system is well developed and has a record of excellent performance. Its potential and deficiencies are well understood. But one finds that its prospects for economic competitiveness, if the full fuel cycle is considered, are not at all promising. As a result, the oxide system appears to have been brought to a dead end. The IFR is thus not a refinement on an already successful thriving system. The IFR is rather a major redirection that shows great promise of leading an otherwise blocked system to one that is viable and economically competitive.

Rocketdyne Division
Rockwell International Corporation
6633 Canoga Avenue
Canoga Park, California 91304

Telex: 698478
ROCKETDYN CNPK

Rockwell International

March 12, 1985 In reply refer to 85RC03468

The Honorable Marilyn Lloyd, Chairman
Subcommittee on Energy Research
and Production
The Committee on Science and Technology
U.S. House of Representatives
Washington, D.C. 20515

Dear Congresswoman Lloyd:

Thank you for the opportunity to supplement the record for the 1985 Subcommittee hearing on the FY 1986 DOE Authorization Request for the Civilian Reactor Development Program and Advanced Nuclear Systems.

The enclosed information covers the requested questions and answers. We would be pleased to provide the committee with any additional information that would assist in evaluating the proposed DOE authorization request.

Sincerely,

G. W. Meyers

G. W. Meyers
Vice President
Atomics International

5067A/ecl

Enclosure as noted

cc: Miss Debbie Johnson
Subcommittee on Energy Research and Production
B374 Rayburn House Building Office
Washington, D.C. 20515

R. E. Harris
Rockwell International

Enclosure
85RC03468

RESPONSE TO ADDITIONAL QUESTIONS FOR G. W. MEYERS

Question

What will be the impact of the proposed FY 1986 budget reductions on the operations at ETEC?

Answer

The proposed FY 1986 budget will have a considerable impact on ETEC. There will be substantially reduced program activity and a 30% decrease in manpower. With the funding available, ETEC will concentrate on those programs of high value and priority to the liquid metal advanced converter and breeder reactor concepts. ETEC will continue to conduct steam generator development and testing, testing necessary for the development of a passive, reliable, decay heat removal system and projects to improve structural integrity and simplify plant licensing. Also, as the budget will allow, ETEC will continue to participate in international exchange programs.

Additional funding could productively be used in support of the innovative reactor concepts. Such activities are not now included in FY 1986 plans due to budget constraints; and, include such things as development and testing of critical components, safety, and programs aimed at reducing reactor capital costs.

Question

I know that over the past year or so, you have been actively pursuing implementation of your Power Pak concept which we have been told would substantially reduce or eliminate the federal responsibility for operation costs at ETEC. Have you made any progress in implementing this concept or obtaining private sector support for this activity?

Answer

Considerable progress has been made on the Power Pak addition to the Sodium Component Test Installation (SCTI) at ETEC. In summary, studies and data have verified that the project is technically feasible, very attractive financially to the U.S. Government, enthusiastically supported by Southern California Edison Company, and the private sector is willing and anxious to bid on the basis of a turnkey lease. More specifically:

1. Over 20 qualified "Blue Ribbon" companies have expressed interest in being potential bidders for a turnkey lease project. They are waiting for ETEC to initiate procurement actions.

2. Southern California Edison, partially at their own expense, conducted a study that verified the Power Pak was not only feasible but ideally suited to the SCTI facility. SCE confirmed their interest and support for this project by correspondence.

3. Purchase versus lease analysis verified desirability of the lease approach and confirmed the favorable payback to the U.S. Government.

4. A complete procurement package has been prepared by ETEC and reviewed by DOE specialists. DOE has recently authorized ETEC to proceed with the bidding process to procure the Power Pak system utilizing the lease-back financing option.

5. Actions are also underway to have FERC qualify the Power Pak as a "Co-Generator," negotiate a Power Sales Agreement with Southern California Edison, and to achieve most favorable rates for natural gas with the Southern California Gas Company.

Question

Has there been any foreign expressions of interest in the innovative design concepts that you are developing?

Answer

We have not discussed our SAFR concept to any great extent with overseas organizations. We have discussed the concept of smaller plants and reasons for application to the U.S. utility market. There is an "academic" interest overseas, however, as many of the safety and design approaches apply to all plant sizes. All overseas programs continue to focus on larger plants. We are strongly in favor of establishing international cooperation and exchange. This can reduce program costs and develop a stronger technology base than otherwise would be possible.

Question

In your judgment, what do you perceive as being the driving issues that will determine the marketability of small, passively safe, and low-cost liquid metal reactors?

Answer

Utility concerns with nuclear power revolve around financial issues and public acceptance. Public acceptance, in turn, depends on health/safety risks and perceived economics. Public acceptance is a key factor influence in utility commission approval of electrical rates. The array of financial concerns on the part of utilities include the need to minimize total funding outlays which are not in the rate base, minimize the time needed for inclusion of investments in the rate base, closely match capacity additions to growth in demand, minimize licensing changes and the associated cost impacts, have competitive/predictable plant costs and short/predictable schedules, and to protect the plant investment once it is in place.

Our innovative design concept should be capable of alleviating and/or circumventing these concerns. Estimates suggest the concept should be capable of being highly cost-competitive, and the enhanced safety approach will result in extremely low risks to public health/safety and protect the plant investment. Further, these safety features which capitalize on the intrinsic properties of sodium and incorporate "self regulating" power characteristics under postulated severe accident conditions will greatly stabilize the licensing process. Factory fabrication and shipment of smaller plants result in lower capital outlays and shorter durations before plant investments are reflected in the rate base. Utilization of these smaller, standardized power modules allow a closer match of utility demand and capacity. These factors collectively are very attractive to utilities and should drive the marketability of small, safe, low-cost LMRs.

Question

From industry's perspective, at what point do you believe the Federal Government support for development of these innovative designs will no longer be necessary? That is, at what point do you believe the industry will be able to pick up the task of marketing and completing the design and development of such reactors without substantive federal support?

Answer

All indications we have received from utility executives indicate great reluctance on their part to invest significant sums in any new reactor concept until there has been a demonstration that the concerns addressed in the previous question have been adequately resolved. It, therefore, seems that no significant utility funding contributions should be expected until, as a minimum, a construction permit has been obtained for the first plant representing a particular concept. Even beyond this point, they are unlikely to cover first-of-a-kind costs.

Vendors are extremely unlikely to contribute major sums to such a program because of the very long time and uncertainty of any return on investment.

In view of the above, Federal Government support undoubtedly will be needed through the successful test operation of the first plant/prototype of any innovative advanced reactor concept.

0034k/ecl

Response to Additional Questions by the Subcommittee

Professor Glenn F. Knoll
Department of Nuclear Engineering
The University of Michigan

1. Several innovative ideas and initiatives are being explored by the Department for the nuclear fission R&D area. Is any attempt being made to involve the universities in these activities? Could you comment on the broad-based capability of the nuclear engineering departments, not only to do research but also policy analysis?

Response:

A number of universities have become involved in advanced reactor concept development. These have included initiatives in the "inherently safe" reactor designs and in various aspects of the liquid metal breeder program. Measured against the activity supported at national laboratories and commercial organizations, however, the volume of this activity is small. For example, funding of all university programs in fission technology amounts to less than $5 million per year. Several university departments have developed initiatives in areas related to policy analysis, particularly with regard to options among various advanced energy systems. The area of policy analysis has not, however, been one of the traditional strengths of nuclear engineering programs as they have evolved historically at most universities.

2. What are your specific recommendations for assuring that an adequate supply of highly talented and trained people are available to the nuclear power industry, presuming that the future of the nuclear power option in the U.S. should be secured?

Response:

We need to take steps to stimulate student interest in nuclear engineering careers both at the undergraduate and graduate levels. At the undergraduate level, there have been recent initiatives supported by the American Nuclear Society, the Institute for Nuclear Power Operations, and individual nuclear industries that show promise of attracting a larger number of high quality students into nuclear engineering careers. At the graduate level, support from the Department of Energy is crucial in maintaining enrollments and the academic strength of existing departments. This support is important in three major areas: student fellowships, university research contracts and grants, and support for campus research reactors. I have detailed each of these areas in my written testimony. Support from the Department will be a crucial factor in assuring an adequate supply of nuclear engineers with advanced degrees in the next decade.

3. What actions are concerned universities taking in order to sustain viable programs in nuclear engineering? Are there opportunities for cross fertilization from other engineering disciplines into the nuclear engineering programs?

Response:

The situation varies greatly from one university to another. Nuclear engineering programs have traditionally been at the forefront of some technologies (such as heat transfer, multiphase flow, and advanced computational techniques) that have widespread overlap with other engineering disciplines. As a result, there has been a natural trend for many departments of nuclear engineering to work with colleagues in other engineering departments to seek research support from agencies outside the traditional nuclear areas. The trend, while providing new avenues for welcome support of research initiatives, carries with it the danger of further diluting the nuclear emphasis on our campuses. It is vitally important that we continue to provide new and exciting opportunities for our students in technical areas that are obviously tied to nuclear energy development.

4. In addition to the need for graduate fellowships in nuclear engineering, is there a need to provide incentives to undergraduates as well?

Response:

There is no question that additional resources could help to encourage greater interest among undergraduates in nuclear engineering careers. Several ways in which the Department could be supportive in this regard immediately come to mind. As one example, the program of undergraduate scholarships currently supported by the Institute for Nuclear Power Operations could serve as a model for a similar program administered through DOE. Additional summer employment opportunities could be provided through many of the Department programs at national laboratories.

5. What size stipends are needed to support a graduate research fellow in nuclear engineering?

Response:

Traditional support levels for graduate student research assistants range from $700 - $1000 per month plus payment of all tuition and fees. This level of support is consistent with stipends provided to graduate students in other branches of engineering.

6. What are the sources of current nuclear engineering departments' funding? Do you foresee any changes in these sources?

Response:

Principal sponsors of research in nuclear engineering programs among the Federal funding agencies have been the Department of Energy, the National Science Foundation, and, to a lesser extent, the Nuclear Regulatory Commission and the Department of Defense. Among industrial sponsors, the Electric Power Research Institute, individual nuclear electric utilities, and the reactor vendors have also been sources of support. As it has become increasing difficult to obtain adequate research support in traditional light water reactor development areas, there has been a tendency on the part of many nuclear engineering programs to seek support from nontraditional sources. Many have been successful, but have risked diluting the nuclear emphasis that provides a distinct identity for nuclear engineering program across the country.

7. What actions would be needed, in improved funding and otherwise, to bring about a return of enrollment to appropriate levels?

Response:

In my prepared testimony, I have outlined three areas of support that are crucial in returning nuclear engineering enrollments to appropriate levels. They are direct support of graduate student fellowships, university-based research grants and contracts, and support of campus research reactors. In addition to funding these activities, the Department of Energy can be of greatest assistance by maintaining an active national program in support of our present light water reactor technology. The most important single factor in determining enrollment levels in nuclear engineering is the public perception of commercial nuclear power in this country. It is crucial that we demonstrate the success of our currently installed nuclear generating capacity to restore public confidence and create an atmosphere in which further nuclear development is deemed to be in the public interest.

NASA
National Aeronautics and
Space Administration
Washington, D.C.
20546

APR 16 1985

Reply to Attn of C:MDD:C-15516f

Ms. Debbie Johnson
Staff
Subcommittee on Energy Research
and Production
Committee on Science
and Technology
House of Representatives
Washington, DC 20515

Dear Ms. Johnson:

Enclosed are responses to written questions resulting from the February 21, 1985, hearing at which Judith Ambrus testified on the subject of the SP-100 program.

This material completes the information requested during that hearing.

Sincerely,

Lynn W. Heninger
Acting Director,
Congressioal Liaison Division

Questions from the House Subcommittee on Energy Research and Production at which Dr. Ambrus testified.

QUESTION 1:

In its September report of last year, NASA's Civil Missions Advisory Group identified five mission categories for which nuclear power systems would either enhance or significantly enable civil missions in the 1990 to 2010 year timeframe. It was a major recommendation of the study that the "initial space station design effort should account for efficient change out from solar to nuclear generated power at some future date." Regarding the matter of public safety as it relates to such space nuclear power systems, the advisory group noted that review processes already in place for the radioisotope systems that have been flown on more than 30 missions will form the basis for safety approval for nuclear reactor systems. In view of these facts, and in view of the fact that the nuclear power systems presently under investigation within the SP-100 program will not be available before flights until the 1990 program will not be available before flights until the 1990 or later timeframe, what is NASA's long-range plan for supporting the development and testing of space nuclear power systems?

ANSWER 1:

NASA is participating with DOD and DOE in the SP-100 Program technology assessment and advancement phase. A system concept selection is planned for the end of FY 1985. The next phase of the SP-100 Program, the ground engineering system development and test phase, is scheduled to start in the second half of FY 1986 and spans approximately five years. The planned NASA activities for this phase are:

1. continuation of civil missions analysis and systems requirements definition;
2. management of non-nuclear advanced technology activities conducted in parallel with the ground engineering systems (GES) development;
3. management of selected GES technology developments as appropriate to NASA capabilities; and,
4. ad hoc technical support of GES development efforts.

Civil mission studies and the advanced technology activities are being conducted to ensure ready suitability of this enabling space power technology for future civil applications. Issues such as design and operations considerations associated with civil mission requirements will be addressed during the GES phase and the subsequent flight system definition and development efforts. At this time, it is anticipated that first flight of a nuclear reactor power system will be on a DOD mission. NASA will continue to assess the use of nuclear space power systems in civil application on the basis of civil program requirements and experience from GES demonstration testing and future DOD flight programs.

QUESTION 2:

Could you tell us if NASA has any plans for future applications of the RTG's that would benefit from further technological advancements in these power sources?

ANSWER 2:

Yes, NASA's Solar System Exploration Division plans to use RTG's as power sources for most of the missions beyond the terrestrial planets. Improved efficiency of the RTG thermal-electric conversion system would reduce the mass requirements on the spacecraft. An increase in the efficiency of the thermal-electric conversion system from the present 6.5 percent to 8-9 percent would result in an increase of the electrical power factor from 2.4 watts per pound to 4.8 watts per pound.

Department of Energy
Washington, D.C. 20585

April 10, 1985

Honorable Marilyn Lloyd
Chairman, Subcommittee on Energy
Research and Production
Committee on Science and Technology
House of Representatives
Washington, D.C. 20515

Dear Madam Chairman:

On February 26, 1985, James W. Vaughan, Jr., Acting Assistant Secretary for Nuclear Energy, appeared before the Science and Technology Subcommittee on Energy Research and Production to discuss the Fiscal Year 1986 authorization for the Nuclear Waste Management Program.

Following that hearing, you submitted written questions for our response to supplement the record. Enclosed are the answers to those questions, which also have been sent directly to the Committee staff.

If you have any questions, please call Ingrid Nelson or Cathy Hamilton of my staff on 252-4277. They will be happy to assist you.

Sincerely,

Robert G. Rabben
Assistant General Counsel
for Legislation

Enclosures

POST-HEARING QUESTIONS AND ANSWERS
RELATING TO THE
FEBRUARY 26, 1985
HEARING BEFORE THE
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION

WITNESS: JAMES W. VAUGHAN, JR.

ACTING ASSISTANT SECRETARY FOR NUCLEAR ENERGY

NUCLEAR WASTE TECHNOLOGY

Question 1: What is the Department doing relative to TRU waste disposal and why are additional moneys needed to study this issue?

Answer: DOE transuranic (TRU) wastes are currently being retrievably stored at six DOE sites. Safe disposal of TRU waste resulting from the defense activities and programs of the United States will be demonstrated in the Waste Isolation Pilot Plant (WIPP) facility in accordance with Public Law 96-164. The Nuclear Waste Policy Act of 1982 did not specifically provide for disposal of civilian TRU waste. However, recognizing that such disposal will likely be necessary, limited generic research and development of processes for treating civilian TRU wastes to produce waste forms acceptable for disposal are planned in FY 1985 and 1986 (approximately $0.5 million each year). These activities will build on the knowledge developed by the Department for defense TRU wastes. Included in this effort is evaluation of TRU treatment strategies such as cement waste form leaching, fuel hull decontamination, and consolidation by metal melting and shredding techniques. Such activities are preliminary to programmatic efforts involving performance of nonradioactive process operations and design demonstration, followed by radioactive testing and evaluation of selected technologies, culminating with comprehensive documentation for transfer to the private sector.

NUCLEAR WASTE TECHNOLOGY

Question 2: Won't all of the Department's TRU waste eventually be disposed of in the WIPP repository, and if so, why is money allocated in the Civilian program for TRU waste disposal?

Answer: The purpose of WIPP is to provide a research and development facility to demonstrate the safe disposal of radioactive wastes resulting from the defense activities and programs of the United States as specified in Public Law 96-164. The Department's defense TRU wastes will be used for the WIPP demonstration. The manner in which civilian TRU waste will be disposed of is, as yet, uncertain.

The Waste Treatment Program conducts research and develops technologies for the immobilization of various types of civilian nuclear waste, including TRU waste. No money has been requested under the Waste Treatment Program specifically for TRU waste disposal activities.

Question 3: How much money is set aside to begin work on a second generation waste form and when will that waste form be available for deployment under the current schedule for development?

Answer: Resources planned for work on a second generation waste form are $200,000 in fiscal year 1985 and $500,000 in fiscal year 1986. No decision has been made on whether to proceed with a second generation waste form.

NUCLEAR WASTE TECHNOLOGY

Question 4: Why shouldn't more money be allocated to the second generation waste form to develop it sooner for possible use in the first repository?

Answer: It has been determined that the borosilicate glass waste form is adequate and suitably cost-effective for the longer-aged (lower power density) high-level radioactive wastes requiring disposal up to at least the year 2000. At this time there is no civilian reprocessing industry and, therefore, no reason to commit scarce resources for the development of a waste form for which there is no near-term need.

NUCLEAR WASTE TECHNOLOGY

QUESTION 5: Please describe what the DOE is doing to develop the information for NRC to generically approve dry storage technologies pursuant to the Waste Policy Act? Please describe your interactions with the NRC.

ANSWER: DOE's Spent Fuel Development program is currently providing NRC the information needed to generically license at-reactor dry storage of spent fuel. Generic R&D, managed by DOE, is establishing peak fuel clad temperatures and heat transfer parameters for dry storage in air, helium, and nitrogen. Cooperative demonstrations with utilities (where the utilities pay 75% of the cost) have been initiated and will result in licensed demonstrations of dry storage technologies. Prior to that time, unlicensed demonstrations at DOE's Idaho National Engineering Laboratory site will provide important design data. These activities will complete the technology base necessary for NRC to consider and provide generic licensing.

At-reactor dry storage license applications are now being processed by the NRC for the cooperative demonstrations. It is anticipated that these applications will be approved on a case-by-case basis over the next two to three years.

After a short demonstration period, which should be completed by the 1989-1990 timeframe, a sufficient data base should exist to allow NRC consideration of generic licensing for specific dry storage technologies.

A strong and effective liason is maintained with the NRC's Office of Nuclear Materials Safeguards and Security (NMSS) and Office of Nuclear Regulatory Research (NRR) to facilitate both licensing activities and generic rulemaking for spent fuel storage technologies. These interfaces with NRC have involved coordination through several different forums of R&D plans and results over the last four years in the development of spent fuel dry storage, rod consolidation, and wet storage technologies.

DOE has discussed at length with NRC means for DOE to assist in confirming the technical bases for NRC's dry storage generic rulemaking. Meetings between DOE's technical experts and the NRC staff have been held to discuss generic design rulemaking for dry storage. NRC has provided staff memoranda to DOE outlining possible NRC schedules for issuing a final rule in 1988, consistent with DOE providing NRC technical bases from development and demonstration activities for confirmation. DOE is currently working with NRC to develop the detailed technical information needs and schedules.

DOE has facilitated resolution of technical issues related to licensing dry storage and rod consolidation demonstrations at reactor sites. Through its participation in technical meetings between NRC's NMSS staff and Virginia Electric and Power Company (Vepco), Carolina Power and Light (CP&L), and Tennessee Valley Authority (TVA), DOE has provided technical information in a timely manner to resolve potential licensing issues. DOE and NRC coordinate their spent fuel R&D efforts through a technical integration group, which includes the participating utilities and DOE's technical contractors. This effort has focused R&D to resolve licensing issues. DOE and its technical contractors have met to review a supplement to the Safety Evaluation Report for GE's Morris, Illinois facility. All NRC questions were answered and the first U.S. test of a large metal dry storage cask was performed at the facility under the R&D provisions (10 CFR Part 72.35) of the existing license. NRC expects to complete their Vepco license review and documentation in September 1985. This will be the first dry storage license issued by NRC under 10 CFR Part 72.

NUCLEAR WASTE TECHNOLOGY

QUESTION 6a: Adequate program planning is a vital element in the administration of government programs. Therefore, please provide a budget chart showing the actual and projected budgets from FY 1982 through FY 1991 for the following activities:

Low-level Waste
Waste Treatment
Spent Fuel Storage Development
Alternative Disposal Concepts
Generic Methods and Supporting Studies
FUSRAP
Grand Junction Remedial Action Project
Uranium Mill Tailings
Surplus Facilities
West Valley

b. Also please provide a short list of the projected yearly goals of these programs in fiscal years 1987 through 1991.

ANSWER: a. The following budget chart reflects the actual obligations from FY 1982 through FY 1984 and projected Budget Authority from FY 1985 through 1990 for Spent Fuel Storage Development, Alternative Disposal Concepts and Generic Methods and Supporting Studies. The projected budget authority for FY 1991 will be determined during the FY 1987 Budget Process.

Program	Actual Obligations		FY 1984	Estimated Obligations		FY 1987	Projected Budget Authority			FY 1991
	FY 1982	FY 1983		FY 1985	FY 1986		FY 1988	FY 1989	FY 1990	
	- (In Millions of Dollars) -									
Spent Fuel Storage Development...	5.8	6.6	5.0	12.7	8.9	6.0	4.8	2.3	0.6	a/
Alternative Disposal Concepts....	3.9	6.0	7.5	11.3	12.5	12.7	12.8	13.0	14.0	a/
Generic Methods and Supporting... Studies........................	2.5	18.1	1.5	1.8	2.3	2.2	2.1	2.1	2.1	a/
Total............	12.2	30.7	14.0	25.8	23.7	20.9	19.7	17.4	16.7	a/

a/ To be determined during FY 1987 Budget Process.

b. The anticipated yearly goals for these programs for Fiscal Years 1987 through 1991 are delineated below.

Spent Fuel Storage Development

FY 1987

- o Complete licensed demonstrations of dry storage in the GNS cask at Browns Ferry.
- o Issue final report on the TVA dry storage demonstration.
- o Assist NUSCO in PWR rod consolidation at the Millstone spent fuel pool.
- o Qualify computer codes for utility use in licensing activities.
- o Complete letter report on the integrity of high burnup assembles during long-term dry storage.
- o Issue topical report on cover gas specification's for long-term storage based on dry storage demonstrations.
- o Continue international cooperation and Federal Interim Storage planning activities.

FY 1988

- o Complete Carolina Power & Light & VEPCO cooperative dry storage demonstrations.
- o Complete rod consolidation demonstrations.

- Issue topical report on results of hot cell examinations of lead test assemblies and dry storage demonstrations.
- Issue topical report on storage system integrity.
- Continue International Cooperation and Federal Interim Storage planning activities.

FY 1989 - FY 1991

- Continue International Cooperation and Federal Interim Storage Planning activities.

Alternative Disposal Concepts

FY 1987

- Complete Three-Dimensional Geophysical Mapping of 2 sites.
- Recover In Situ Heat Transfer Experiment.
- Complete Site-Specific Circulation Model.

FY 1988

- Nominate Site for Future Study and prepare a site Qualification Plan.
- Complete Deep - Sampling Geoscience Verification of 2 sites.
- Conduct hole closure emplacement Test.
- Complete Canister-Sediment Migration Analyses.
- Analyze ISHTE Experimental Data.
- Complete assessment of Far-Field Radionuclide Transport.

- o Complete Acquisition of Site-Specific Biological and Physical Oceangraphic Data.

FY 1989

- o Complete Safety Analyses
- o Recommend Legal and Institutional Systems for Subseabed Disposal Program.

FY 1990

- o Issue scientific and environmental feasibility report.

FY 1991

- o Develop and verify all units of the system model.
- o Initiate long-term in-situ experiments and pre-conceptual design.

Generic Methods and Supporting Studies

FY 1987 - 1991

- o Support the following fellowship's:
  - Nuclear Engineering, Health Physics and Radioactive Waste Management Fellowship administered by ORAU.
  - University/DOE Laboratory Cooperative Program--- Nuclear Waste Research administered by the Northwest College and University Association for Science (University of Washington/Joint Center for Graduate Study.)

  - Historically Black Colleges and Universities Radioactive Waste Management and Research Program pursuant to Executive Order 12320.

- o Participate and support nuclear waste management symposiums and seminars; for example:
  - Materials Research Society Symposium on the Scientific Basis for Nuclear Waste Management.
  - Annual University of Arizona Waste Management Symposium that is co-sponsored by DOE, American Nuclear Society, EPRI and the Radioactive Systems Committee of the American Society of Mechnical Engineers.
- o Conduct supporting studies in the field of waste management, for example,
  - National Academy of Science's Board on Radioactive Waste Management core support activities for storage, transportation and final disposal.
  - Bureau of Mines U.S. National Committee for Rock Mechanics support in the area of nuclear-waste disposal geologic storage techniques.
  - Bureau of Mines U.S. National Committee on Tunneling Technology support in the areas of storage of nuclear waste; techniques and

procedures for exploration, site analysis, rock disintegration, cavity support and materials handling; and underground construction.

  - Support Small Business Innovative Research activities pursuant to P.L. 97-219.

- Cooperate and participate in international waste management activities, for example,
  - International Sorption Information Retrieval System data collection and computer software generation project that aids the international nuclear waste disposal community in the management of nuclide adsorption and solubility data.
  - International Program Support Office (PNL/RL) maintains a center for collection, organization, assembly and analysis, evaluation and dissemination on foreign fuel cycle and waste management activities.
  - Technical Assistance to Nonnuclear Weapon States pursuant to Section 223 of NWPA.

NUCLEAR WASTE TECHNOLOGY

Question 6: (a) Adequate program planning is a vital element in the administration of government programs. Therefore, please provide a budget chart showing the actual and projected budgets from FY 1982 through FY 1991 for the following activities:

Low-Level Waste
Waste Treatment
Spent Fuel Storage Development
Alternative Disposal Concepts
Generic Methods and Supporting Studies
FUSRAP
Grand Junction Remedial Action Project
Uranium Mill Tailings
Surplus Facilities
West Valley

Answer: The actual and projected budgets from FY 1982 through FY 1990 for the requested activities are attached. Projected budget authority for FY 1991 will be determined during the FY 1987 budget process.

Nuclear Waste Technology
Funding Summary
(BA in Thousands)

	FY 1982	FY 1983	FY 1984	FY 1985	FY 1986	FY 1987	FY 1988	FY 1989	FY 1990	FY 1991
Low-Level Waste	$ 6,515	$ 7,395	$ 8,150	$ 6,215	$ 4,750	$ 4,400	$ 3,100	$ 1,000	$ 1,000	a/
Waste Treatment	4,210	7,603	5,570	6,300	6,450	10,400	10,900	9,000	8,400	a/

a/ To be determined during FY 1987 budget process.

Remedial Actions
Funding Summary
(BA in Thousands)

	FY 1982	FY 1983	FY 1984	FY 1985	FY 1986	FY 1987	FY 1988	FY 1989	FY 1990	FY 1991
FUSRAP	$11,245	$11,700	$16,900	$17,966	$ 17,700	$ 23,000	$ 26,000	$37,000	$45,000	a/
Grand Junction	1,672	1,672	1,500	1,500	900	0	0	0	0	0
UMTRAP	17,800	20,834	27,834	61,990	110,000	179,980	126,400	59,500	225	0
Surplus Facilities	11,975	12,933	15,410	29,500	39,000	54,000	58,000	47,000	51,000	a/
West Valley	9,972	14,900	36,000	47,900	64,000	90,419	76,925	65,675	39,390	a/

a/ To be determined during FY 1987 budget process.

NUCLEAR WASTE TECHNOLOGY

Question 6: (b) Also please provide a short list of the projected yearly goals of these programs in fiscal years 1987 through 1991.

Answer: A short list of the projected goals is provided for each of these programs as follows: Table 1, Low-Level Waste; Table 2, Waste Treatment; Table 3, Spent Fuel Storage Development; Table 4, Alternative Disposal Concepts; Table 5, Generic Methods and Supporting Studies; Table 6, FUSRAP; Table 7, Grand Junction Remedial Action Project; Table 8, Uranium Mill Tailings; Table 9, Surplus Facilities; and Table 10, West Valley. Projected budget authority for FY 1991 will be determined during the FY 1986 budget process.

Table i

Low-Level Radioactive Waste Management

Annual Goals FY 1987-1991

FY 1987

- Provide technical support to States to assist in developing an effective nationwide system for low-level radioactive waste management and disposal.

FY 1988

- Facilitate and assist in the development of new low-level waste disposal capacity among States and regions.

FY 1989

- Provide limited technical support and information assistance for the development of new low-level waste disposal capacity among States and regions.

FY 1990

- Provide a centralized data base and information management system to support development of an effective nationwide system of low-level radioactive waste disposal.

FY 1991

- Provide a centralized data base and information management system to support development of an effective nationwide system of low-level radioactive waste disposal.

Table 2

Waste Treatment

Annual Goals FY 1987-1991

FY 1987

- Decision point for continuation of second generation high-level waste form development.
- Continue pilot-scale radioactive testing of the ceramic melter system.

FY 1988

- Complete high-level waste pilot-scale radioactive testing for West Valley.

FY 1989

- Complete high-level waste pilot-scale radioactive testing for commercial waste feed compositions.

FY 1990

- Complete high-level waste pilot-scale melter decontamination and decommissioning.

FY 1991

- Fabricate and install experimental pilot-scale treatment system for radioactive TRU wastes.

Table 6

Formerly Utilized Sites Remedial Action Project

Annual Goals FY 1987-1991

FY 1987

- Wayne/Pequannock, NJ: complete cleanup of vicinity properties.
- Colonie, NY: complete vicinity property cleanup.
- Maywood, NJ: start remedial action on large industrial properties (e.g., Sears and Scanel properties).
- NJ Disposal Site: complete site screening process (NJ State lead).

FY 1988

- Maywood, NJ: complete remedial action on Sears and Scanel properties.
- Albany, OR: initiate remedial action.
- NY Disposal Site: complete site screening process (NY State lead).
- St. Louis Airport Storage Site, MO: begin preparation of site for waste disposal.

FY 1989

- Albany, OR: complete remedial action.
- Dupont, NJ: initiate remedial action.
- Maywood, NJ: complete remedial action on vicinity properties and interim storage operations.
- NJ Disposal Site: begin development of the disposal site.

FY 1990

- Dupont, NJ: complete remedial action.
- Universal Cyclops, PA: initiate and complete remedial actions.
- Shpack Landfill, MA: begin remedial action.
- NY Disposal Site: begin development of the disposal site.
- St. Louis Airport Storage Site, MO: complete preparation of disposal site.
- Hazelwood, MO: initiate transfer of waste from Latty Avenue site.

Table 6

(continued)

FY 1991

- Middlesex Sampling Plant, NJ: begin removal of stored wastes to NJ Disposal Site.
- Maywood, NJ: begin removal of stored wastes to NJ Disposal Site.
- Wayne/Pequannock, NJ: begin removal of stored wastes to NJ Disposal Site.
- Shpack Landfill, MA: complete remedial action.
- MO Disposal Site: begin site screening process (MO State lead).
- St. Louis Airport Storage Site (vicinity properties): complete cleanup of contaminated ditches.
- Hazelwood, MO: complete transfer of waste from Latty Avenue.

Table 7

Grand Junction Remedial Action Project

(Public Law 92-314)

Annual Goals FY 1987-1991

FY 1987

- Start remedial action at the last 16 of the estimated 604 properties in the project.
- Perform additional cleanup at 16 previously remediated properties.
- Verify completions and send closeouts for 30 properties to owners.

FY 1988

- Perform additional cleanup on remaining sites, as needed.
- Verify completion and send closeouts on 32 properties to owners.
- Close out all remaining project activities.

FY 1989-1991

- None, project completed in FY 1988.

Table 8

Uranium Mill Tailings Remedial Action Project

(Public Law 95-604)

Annual Goals FY 1987-1991

FY 1987

- Complete all National Environmental Policy Act documentation.
- Initiate engineering at Slick Rock, CO, and Maybell, CO.
- Complete engineering and initiate remedial action at Grand Junction, CO; Rifle, CO; Ambrosia Lake, NM; Naturita, CO; and Monument Valley, AZ.
- Initiate remedial action at Mexican Hat, UT.
- Complete remedial action at Gunnison, CO; Riverton, WY; and Lakeview, OR.

FY 1988

- Complete all planning and design activities.
- Initiate engineering at Falls City, TX; Green River, UT; Belfield, ND; Bowman, ND; Lowman, ID; and Spook, WY.
- Complete engineering and initiate remedial action at Falls City, TX; Green River, UT; Slick Rock, CO; and Maybell, CO.
- Complete remedial action at Salt Lake City, UT; Durango, CO; Tuba City, AZ; Mexican Hat, UT; Ambrosia Lake, NM; Naturita, CO; and Monument Valley, AZ.

FY 1989

- Complete all engineering activities.
- Complete remedial action at: Grand Junction, Rifle, and Slick Rock, CO; Lowman, ID; Spook, WY; Falls City, TX; Green River, UT; Belfield and Bowman, ND.

FY 1990

- Verify completion of work at all processing sites and vicinity properties.
- Apply for NRC license for continuing maintenance and surveillance at all sites.
- Phase out all remaining project activities.

FY 1991

- None, project completed in FY 1990.

Table 9

Surplus Facilities Management Program

Annual Goals FY 1987-1991

FY 1987

- Canoga Park, CA: complete Nuclear Materials Development Facility decommissioning; start SNAP-8 Facility decommissioning.
- Argonne National Laboratory, IL: complete ANL-East Surplus Facilities decommissioning; start Experimental BWR Facility decommissioning.
- Los Alamos Scientific Laboratory, NM: start TA-52 UHTREX Facility decommissioning.

FY 1988

- Mound, OH: complete cleanup and restoration of Mound ANSPD Areas.
- Idaho National Laboratory, ID: complete BORAX-V Facility decommissioning.
- Los Alamos Scientific Laboratory, NM: complete TA-52 UHTREX Facility decommissioning.
- Savannah River, SC: start Heavy Water Components Test Reactor decommissioning.

FY 1989

- Canoga Park, CA: complete disposal of sodium/lithium; complete SNAP-8 Facility decommissioning; start Nuclear Development Test Facility decommissioning.
- Oak Ridge National Laboratory, TN: start Homogeneous Reactor Experiment Facility decommissioning.

FY 1990

- Shippingport, PA: complete Shippingport Station decommissioning.
- Canoga Park, CA: complete Radioactive Material Development Facility decommissioning.
- Los Alamos Scientific Laboratory, NM: complete TA-2 Water Boiler Reactor decommissioning.
- Richland, WA: complete Plutonium Recycle Critical Facility decommissioning.

FY 1991

- Monticello, UT: complete Monticello site remedial actions for long-term management of the tailings.
- Savannah River, SC: complete Heavy Water Components Test Reactor decommissioning.
- Los Alamos Scientific Laboratory, NM: start and complete TA-35 LAPRE II reactor vessel decommissioning.
- University of California, CA: start and complete UC-Davis Waste Retention System decommissioning.

Table 10

West Valley Demonstration Project

(Public Law 96-368)

Annual Goals FY 1987-1991

FY 1987

- Complete design of high-level waste sludge mobilization system.
- Begin modifications to high-level waste tank.
- Complete supernate treatment.

FY 1988

- Complete installation of high-level waste sludge mobilization equipment.
- Complete installation of high-level waste interim storage equipment.
- Start waste vitrification.

FY 1989

- Continue waste vitrification operations.

FY 1990

- Complete waste vitrification operations.
- Begin decommissioning of facilities hardware and materials used in waste solidification.

FY 1991

- Continue interim high-level waste storage and decommissioning activities.

REMEDIAL ACTION PROGRAM

Question 7: The peak year expenditure year in the Remedial Action Uranium Mill Tailings program is Fiscal Year 1987 where DOE projects a budget of $192 million. Please provide the Subcommittee with a budget chart showing the total fiscal year expenditure for each uranium mill tailings project based on extending the program through Fiscal Year 1993.

Answer: The attached table shows the Uranium Mill Tailings Remedial Action Project extended from the current March 1990 completion date to a Fiscal Year 1993 completion date. It should be noted that the projected budget of $192 million in FY 1987 reflects the total project cost in that fiscal year. The DOE share of that total is estimated to be $180 million in FY 1987.

ALTERNATIVE BUDGET PROFILE

URANIUM MILL TAILINGS REMEDIAL ACTION PROJECT
TOTAL PROJECT COST BY SITE
BY FISCAL YEAR
(DOLLARS IN THOUSANDS)

Site	Prior Years	1985	1986	1987	1988	1989	1990	1991	1992	1993	Total
Canonsburg, PA	29,453	13,667	115	123	130	139	75	6	7	7	43,722
Salt Lake City, UT	16,019	22,404	37,211	39,518	157	55	29	32	34	37	115,496
Shiprock, NM	4,593	5,399	8,396	49	52	55	29	32	34	37	18,676
Durango, CO	4,240	5,025	11,777	15,376	13,233	139	75	79	86	91	50,121
Gunnison, CO	2,742	476	6,037	8,900	412	139	75	79	86	91	19,037
Grand Junction, CO	7,587	7,491	17,834	38,688	32,926	22,708	32,728	27,624	21,927	22,332	231,845
Rifle, CO	1,903	1,491	3,305	5,802	13,808	3,127	104	0	0	0	29,540
Riverton, WY	2,495	2,969	8,515	8,728	130	139	75	79	86	91	23,307
Tuba City, AZ	1,850	404	3,233	9,246	1,046	61	30	32	34	37	15,973
Mexican Hat, UT	1,794	438	948	394	15,109	1,092	29	32	34	37	19,907
Lakeview, OR	1,974	1,230	4,968	6,282	8,002	54	29	32	34	37	22,642
Ambrosia Lake, NM	1,257	449	647	1,475	5,911	16,566	29	32	34	37	26,437
Naturita, CO	1,257	615	1,201	597	171	28	5,597	3,593	68	37	13,164
Falls City, TX	1,311	44	901	787	2,785	6,829	12,267	109	34	37	25,104
Green River, UT	1,352	66	577	234	1,320	167	46	3,528	4,965	37	12,292
Slick Rock, CO	1,309	11	671	417	759	153	29	7,391	3,602	37	14,379
Belfield, ND	1,308	22	629	234	601	404	45	0	4,386	37	7,666
Bowman, ND	1,308	6	618	246	458	417	60	0	4,523	37	7,673
Maybell, CO	1,254	0	682	553	510	41	29	7,186	6,877	18	17,150
Lowman, ID	1,308	33	289	417	661	545	45	0	0	4,925	8,223
Spook, WY	1,254	0	289	417	484	363	45	0	0	3,208	6,060
Monument Valley, AZ	1,322	576	393	3,535	5,144	153	63	64	61	73	11,384
Edgemont, SD	1,444	1,097	2,980	196	0	0	0	0	0	0	5,717
Total	90,334	63,913	112,216	142,214	103,809	53,374	51,533	49,930	46,912	31,280	745,515
DOE Share	87,796	61,990	110,000	120,132	94,837	48,683	46,885	45,394	42,670	28,496	686,883

WEST VALLEY DEMONSTRATION PROJECT

Question 8:	The Department has identified a problem of contaminated kerosene seeping from buried tanks at the low-level waste burial ground. Would you describe this problem and DOE's solution to it? Since this problem is not due to the project activities at the site, is DOE seeking reimbursement for its expenses in addressing this public health hazard at the site? If not, why not? Whose responsibility is this clean-up?
Answer 8:	During commercial operation (1966-1972), plant operating waste was disposed in a designated area, the NRC Licensing Disposal Area (NDA), under a license from the NRC jointly to New York State Energy Research and Development Authority (NYSERDA) and the plant operator, Nuclear Fuels Services. Routine monitoring of a network of wells, installed by NRC for hydrogeologic studies, revealed (November 1983) the presence of contaminated organic solvent, the source of which was identified as leaking tanks of disposed solvent in the NDA. The Department, as site operator under provisions of a Cooperative Agreement between DOE and NYSERDA, moved promptly to maintain public health and safety by determining the extent of the contamination, placing recovery wells, and pumping and storing the recovered solvent. Through January 1985, about 600 gallons has been recovered. About $150 thousand has been spent to date. Based on plant records, two disposal holes have been identified as the probable source of the contamination. The Department believes it is prudent to uncover the tanks, inspect them, and to undertake a more permanent stabilization. Estimated cost for doing this is $1.5 million (FY 85/86).

Answer 8: (continued)

The Department is the site operator and as such is responsible during the term of the Project for taking such actions as are necessary to maintain the public health and safety. Under the terms of the Cooperative Agreement with the State of New York, it is explicit that permanent long term remedial activities are the responsibility of NYSERDA, as owner and license holder. Thus, the Department is not responsible for remedial activities to preclude problems in this disposal area associated with previous disposal operations. The question of the formal point of delineation between these responsibilities may be difficult to determine with precision. The West Valley Demonstration Project Act does not stand in isolation from other laws and agreements among the private plant operator, NYSERDA, DOE, and NRC. Legal efforts to define precise responsibility could be more costly to the taxpayers and to the environment than simply fixing the problem.

At this time, the Department is planning to explore the problem further and undertake permanent stabilization of only the two disposal holes in question. New York State's participation in this phase is being considered as a Project cost. The Department will not undertake general remediation in this disposal area nor long-term corrective actions with future occurrences.

WEST VALLEY DEMONSTRATION PROJECT

Question 9: If DOE were to move the TRU waste at the site to the Idaho storage facility whenever it became necessary to make such a shipment, could the project be saved any expense at the project site? If yes, why hasn't this activity been scheduled?

Answer: A limited amount of TRU waste is estimated to be generated by the Project. To date we have generated about 120 cubic feet and estimate about 10,000 cubic feet will be ultimately produced. After interim on-site storage, DOE is planning to move the TRU waste off-site. It will be necessary to provide specialized equipment to remove and treat as much of the TRU contamination as is feasible and to reduce the size of large components. To undertake packaging and shipment to an interim storage site prior to these treatments would be prohibitively expensive for little actual cost avoidance. Should a repository not be available by the time Project activities begin to wind down, shipment to another DOE site seems to be a reasonable approach.

WEST VALLEY DEMONSTRATION PROJECT

Question 10: Would you please identify the monetary commitment of the State of New York to this project in Fiscal Year 1986 and relate this amount to that required under the law?

Answer: New York State is required to pay 10 percent of project costs. The Cooperative Agreement with NYS defines project costs as the sum of DOE costs, facility credit, and NYS services and cash payments. NYS pays its 10 percent share each year. In FY 1986 we estimate NYS services and cash payments to be about $2 million. The remainder of NYS' FY 1986 obligation is expected to be covered by facility credits as specified in the DOE/NYSERDA Cooperative Agreement.

Question 11: (a) Why is the facility considered to have any residual value when as it exists now, it is merely a liability because of the contamination at the site?

Answer: The Project is using the existing facility for housing systems for radioactive waste treatment, size reduction and TRU decontamination, low-level and TRU waste assay, waste reduction, solidified waste canister storage, and TRU waste interim storage. In addition, we are using the facility analytical capabilities, utilities, off-gas system, ventilation system, maintenance shops, etc. While a detailed cost comparison cannot be made, the value of these facility capabilities to the Project has been agreed in the negotiated Cooperative Agreement to be $12 million.

WEST VALLEY DEMONSTRATION PROJECT

Question 11:	(b) Is it indeed cheaper to utilize this facility rather than building a totally new facility nearby, dedicated to the exclusive purpose of the solidification program? If not, then why are facilities credits factored in the program at all? Isn't the idea of the facility credit to give New York State credit for the value of the facility to the demonstration project?
Answer:	The approach we are using is to make maximum practical use of existing facilities where this will not compromise critical path activities, taking into consideration environmental, health, and safety needs as well as operating and maintenance considerations. We currently believe that this is the least expensive approach. Under this policy, the only new major construction is a small hot cell adjacent to existing facilities to house the glass furnace for solidifying the high-level waste (i.e., Component Test Stand). We will decontaminate and reuse existing facilities for essentially all supporting equipment and operations. We have rejected construction of a new stand-alone facility for carrying out the Project because it would have cost upwards of $40 million just for a structure which would be used only for 1-1/2 to 3 years. Although detailed cost comparisons cannot be made, it appeared not to be cost effective to pursue that approach. As discussed above, the existing facility does provide valuable facility and systems support to waste solidification. The new Component Test Stand noted above was one exception; to have placed a first-of-a-kind system

Answer:	(continued) in contaminated cells with poor access for remote installation, operation, maintenance, and dismantlement would not have been attractive from a cost, schedule, and technical viewpoint.

WEST VALLEY DEMONSTRATION PROJECT

Question 11:	(c) Why shouldn't this Committee require a greater monetary contribution from the State of New York in this project?
Answer:	The Cooperative Agreement (Section 5.03(b)) states that New York State shall pay its 10 percent share by expending funds for the provision of services, by expending a portion of the facility credit, and by paying the balance by check or other negotiable instrument. The Department has encouraged New York State to use cash payments rather than facility credits during the critical years of FY 1986 and 1987; however, the Cooperative Agreement permits New York State to structure its payment as a combination of authority services, facility credit, and cash payments.

WEST VALLEY DEMONSTRATION PROJECT

Question 12: How much is the West Valley Project going to cost the government, including the cost of decontaminating those parts of the facility used in the project?

Answer: The Total Project Cost Estimate is $472.8 million through waste solidification (FY 1990). Of this total, the cost to the government is estimated to be $445.8 million. Estimation of post-solidification costs, including decontamination of those parts of the facility used in the Project, are being developed. A preliminary estimate will be available in late 1985 for the post-solidification phase of the Project. The costs are likely to be much less than the costs through solidification unless a decision is made to return the premises to unrestricted use. The final cost estimate depends upon such factors as the outcome of the NEPA process for final decommissioning, future NYS use of site, NRC decontamination requirements, and the availability of a Federal storage facility or repository. The solidified waste will be stored at West Valley until a Federal high-level waste receiving facility is available.

UTILITY PARTICIPATION

QUESTION 13: This Committee has encouraged the Department to cooperate with the utility industry in its oversight of the Waste Fund program. What is your Office doing to involve the utilities in the process.

ANSWER: We are involved in a number of activities involving the utilities and initiated both by the utility industry and DOE. For example, the utility industry has established a Utility Nuclear Waste Management Group (UNWMG) comprised of 41 investor-owned and public nuclear utilities, to provide active utility oversight of the Nuclear Waste Fund program. We are cooperating fully with this group in its oversight of our activities. A full-day briefing was provided to the UNWMG in early March by our Headquarters' Office of Geologic Repositories. In addition, meetings between the UNWMG and each of our three project offices for the first geologic repository program are being arranged for May. We believe our interactions with the UNWMG will be beneficial and look forward to receiving their constructive suggestions.

The Secretary of Energy, numerous staff members of my office and I regularly participate in scientific and technical symposia and conferences sponsored by utility and industry groups to share the latest current information on program activities.

Further, in response to recommendations by a task force established by the Edison Electric Institute and made up of Chief Executive Officers to evaluate utility industry efforts that were ongoing regarding spent fuel disposal, the industry established a group known as the American Committee on Radioactive Disposal, ACORD. It is a small group made up of eight senior utility executives. The stated goal of the group is to provide utility industry input to assist the Federal Government in the development and implementation of the national nuclear waste disposal program. As Director of the Office of Civilian Radioactive Waste Management, I have been invited to meet with ACORD on several occasions and have done so.

And, in response to industry comment regarding the availability of financial records for review, we have engaged an international public accounting firm, Main Hurdman, to provide an annual audit and financial statement comparable to that found in a private business operation.

FOOD IRRADIATION

Question 14: What are the major barriers, other than regulatory, to commercializing a food irradiation industry in the U.S.?

Answer: At the current time the major barriers, other than regulatory, are lack of: industrial acceptance, public acceptance, and reliable supplies of radiation sources.

FOOD IRRADIATION

Question 15: If the regulatory concerns are resolved, will there be enough cesium 137 to support a modest-sized food irradiation industry?

Answer: The Department is evaluating the feasibility of recovering Cesium-137 for irradiation sources from existing and anticipated high-level radioactive wastes resulting from DOE operations. A crude estimate of the amounts of such Cesium-137 that could be made available is 150 million curies. Costs and schedules are not yet completed. Planning studies are being conducted to ascertain what it would take to make additional cesium available for irradiation of food and other commodities. Results of these studies will be available in FY 1985. If the estimated 150 million curies of Cesium could be recovered, some 50 modest-sized food irradiation facilities could be supported. It should be noted, however, that Cobalt-60 would be preferred over Cesium-137 as a radiation source, if it were reliably available at competitive prices. Therefore, expected expansion in the world supply of Cobalt-60 could sharply diminish market demand for Cesium-137; and the revenue from Cesium sales might not then be sufficient to recover the costs of Cesium production.

FOOD IRRADIATION

Question 16: What research on food irradiation is currently being carried out by the Byproducts Utilization Program within the Department of Energy?

Answer: The Byproducts Utilization Program is currently participating with the U.S. Department of Agriculture in research on irradiation of pork, grapefruit, and mangos. The Department's role is in the area of radiation sources and facility design. The Department of Agriculture analyzes the food after irradiation. In addition, the Food and Drug Administration is also involved since they establish food irradiation regulations.

Question 17: Is DOE involved in technology transfer activities dealing with our current knowledge of the food irradiation process with private industry and/or other countries?

Answer: The Department is involved with the National Pork Producers Council, the National Food Processor's Association, the International Atomic Energy Agency (IAEA), and the Food and Agricultural Organization of the United Nations (FAO) with regard to transferring technology related to food irradiation processes. For example, the Department cosponsored with the Agency for International Development, IAEA, and FAO, the recent International Symposium on Food Irradiation Processing held in Washington, D.C., March 4-8, 1985.

SEWAGE SLUDGE IRRADIATION

Question 18: What amount of funding has been requested for FY 1986 sludge irradiation research activities?

Answer: No funding has been requested for sludge irradiation research activities in FY 1986. The Department believes that research and development of sludge irradiation technology has progressed to a level sufficient for the private sector to adapt it for commercial applications, if desired.

Question 19: What is the status of the shipping casks for cesium 137 which were to have been finished in 1984? What is the new timetable for their completion?

Answer: Fabrication of the stainless steel shipping cask for Cesium-137 has been completed. The Department is currently reviewing the related Safety Analysis Report. Application to the NRC for certification of this cask is planned for May 1985. The other (ferritio) cask is scheduled for completion of fabrication and testing by August 1986. Application to the NRC for certification of this cask is planned for October 1986.

MINORITY QUESTIONS

Question 20: A few weeks ago DOE dedicated the Radioactive Liquid-Fed Ceramic Melter System at the Battelle Northwest Labs. This facility will be used to solidify high-level waste into a borosilicate glass in preparation for permanent disposal.

(a) Could you explain in more detail how DOE plans to use this facility to solidify the high-level waste at the former spent fuel reprocessing plant at West Valley?

Answer: The Department does not plan to directly use this facility to solidify the West Valley high-level waste. Rather, the Battelle ceramic melter serves as technical backup to the West Valley melter. It will be used to study the process by which waste is incorporated into borosilicate glass, thereby gaining valuable operating and process control data as well as important maintenance experience with radioactive vitrification systems in a remote environment. Additionally, support will be provided in terms of product development and quality assurance by providing samples of West Valley composition glass for further testing in order to aid in qualifying the West Valley waste for disposal in a geologic repository.

Question 20: (b) Does DOE expect this technology to become the major vitrification technique used for all our high-level defense wastes?

Answer: This basic technology has been selected for solidification of defense high-level waste located at the Department's Savannah River Plant. Studies underway strongly indicate that the liquid-fed ceramic melter vitrification technology will also be used for a portion of the Hanford site's defense wastes. Solidification technology for immobilization of Idaho's defense waste will be determined in approximately 5-10 years; crystalline ceramic waste forms are currently favored because of their potential for accommodating the high waste loadings associated with the unique Idaho waste composition.

MINORITY QUESTIONS

Question 20: (c) Could you explain in more detail how DOE plans to work with West Germany for demonstration tests using the waste melter?

Answer: The objective of the collaboration under the U.S.DOE/Federal Republic of Germany Project Agreement is to undertake a joint experimental and analytical program for the development of processes for the treatment and immobilization of high-level radioactive waste. For its part, the Department is contributing its experience, technology, facilities, and personnel while the Federal Republic of Germany is contributing towards the cost of operating the facility and melter system. This collaboration will provide the U.S. and the Federal Republic of Germany with valuable experience on the operation of radioactive melters. The Federal Republic of Germany plans to use the isotopic sources of radiation and heat produced from operating the melter for testing and evaluation under the actual conditions of a salt repository.

Question 21: (a) Your statement also mentions the decontamination and decommissioning of the Shippingport Reactor. Where do you plan to dispose of the reactor vessel and other contaminated components of the Shippingport reactor? At Hanford?

Answer: Final disposal of all radioactive solid waste material and components, including the reactor vessel, will be buried at the DOE low-level waste disposal facility at Hanford, Washington.

MINORITY QUESTIONS

Question 21: (b) How will you transport the reactor vessel?

Answer: In the preferred method, the reactor vessel, internal and neutron shield tank will be removed from the plant as one package and shipped to the Hanford site by barge for burial. The route will follow the Ohio River, Mississippi River, through the Panama Canal, up the Pacific West coast, and the Columbia River. Short distance land transport to the waste site will be by special heavy-duty transporters.

An optional method of transport is by rail. Actual transportation will be determined by selection of competitive bid contracts. The Department is not currently intending to limit the contractor by predetermining the transportation method. Selection will be made on the basis of cost-effectiveness and least schedule risk.

MINORITY QUESTIONS

Question 22: We have been concerned that DOE is not distributing its available supplies of cesium 137 on an equitable basis. Could the Department outline in detail the procedures that were followed in determining what domestic and foreign operations would receive shipments of cesium 137?

Answer: The Department has not made a final decision on the allocation of supplies of Cesium-137 but will allocate on an equitable basis within the constraints of guiding statutes and regulations. In late 1983, the Department began serious consideration of lease arrangements which would encourage beneficial uses of Cesium-137. Just as this became known among major users of gamma radiation sources, a world scarcity of Cobalt-60 was developing. As a result, there was a rush of industrial orders which exceeded the available supply. In addition, DOE programs required some 30 percent of the available Cesium-137 to meet its project needs. Recognizing that not all the expressed demand could be satisfied, the Department is considering a tentative allocation which was based on priorities requirements by DOE programs and the U.S. private sector. That allocation includes some 10 MCi of Cesium-137 held in reserve for future priority requirements not yet clearly identified. Only one party seeking to obtain Cesium in large quantities has yet obtained the requisite license. Final allocations to the private sector will favor those who can establish firm orders and schedules for shipment over those who are not

MINORITY QUESTIONS

Answer 22: (continued)

ready (e.g., licensing status) to make those commitments, since beneficial usage is to be promoted over idle ownership. The priorities listed in Section 81 of the Atomic Energy Act of 1954 as amended will also be considered.

Question 23: We understand that there may be a reserve of cesium 137 (about 7-10 million curies) that has not yet been committed for distribution. Could DOE give the Subcommittee an indication of how they plan to distribute this reserve supply of source material?

Answer: Recognizing that there may be future requirements for Cesium-137 that would warrant some allocation, the Department has put into reserve some 10 million curies. Distribution of these reserves has not yet been determined.

MINORITY QUESTIONS

Question 24: Why is DOE nuclear energy considering sending 7 million more curies of cesium 137 to West Germany when there is a shortfall of source material for domestic users?

Answer: The Department of Energy and the Federal Minister for Research and Technology of the Federal Republic of Germany (FRG) have in-place project agreements for cooperation on (1) development of processes for the treatment and immobilization of high-level radioactive wastes, and (2) conduct of experiments and testing with radioactive wastes in a salt mine (in the FRG). To satisfy the agreement under item (1) above, supplies of Cesium-137 and Strontium-90 were requested in March 1984 for immobilization studies and preparation of isotopic heat sources for the salt mine testing. The Department's radioactive liquid-fed ceramic melter facility at Richland, Washington, will be used for the cooperative activities under item (1). Although 10 million curies of Cesium-137 was requested for the work under item (1), the current potential shortfall of Cesium has necessitated restriction of this allocation to 7 million curies. The Cesium-137 to be allocated for the DOE cooperative agreement with West Germany will be dregs that were left over from the Cesium-137 encapsulation project and those capsules of Cesium that are considered least desirable for use in the DOF leasing program.

MINORITY QUESTIONS

Question 25: We have reason to believe that some organizations which have been put on the distribution list for cesium 137 do not intend to use it. For instance, Radiation Technology is on the list to receive up to 12 million curies, yet that firm is on record as saying that they will not be able to use the cesium immediately. Has DOE considered instead distributing the cesium to other domestic operators who can use the material immediately?

Answer: The Department of Energy realizes that all of those who have expressed an interest in civilian domestic use of Cesium-137 may not be ready to invest in the acquisition of required licenses from the NRC or an agreement State. Final allocations to the private sector will favor those who can establish firm orders and schedules for shipment over those who are not ready (e.g., licensing status) to make those commitments, since beneficial usage is to be promoted over idle ownership.

Department of Energy
Washington, D.C. 20585

April 10, 1985

Honorable Marilyn Lloyd
Chairman, Subcommittee on Energy
  Research and Production
Committee on Science and Technology
House of Representatives
Washington, D.C. 20515

Dear Madam Chairman:

On February 26, 1985, Ben C. Rusche, Director of the Office of Civilian Radioactive Waste Management appeared before the Science and Technology Subcommittee on Energy Research and Production to discuss the Fiscal Year 1986 authorization for the Nuclear Waste Management Program.

Following that hearing, you submitted written questions for our response to supplement the record. Enclosed are the answers to those questions, which also have been sent directly to the Committee staff.

If you have any questions, please call Ingrid Nelson or Cathy Hamilton of my staff on 252-4277. They will be happy to assist you.

Sincerely,

Robert G. Rabben
Assistant General Counsel
for Legislation

Enclosures

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March 18, 1985

Mr. Ben Rusche
Director
Office of Civilian Radioactive Waste
U.S. Department of Energy
Washington, D.C. 20585

Dear Mr. Rusche:

Thank you for your excellent testimony at our February 26, 1985 Subcommittee hearing on the FY 1986 DOE Authorization Request for the Nuclear Waste Management Program.

We would like to supplement the record of the hearing with your responses to the attached questions. We would appreciate receiving your responses within three weeks from the date of this letter. Please forward this information to the Subcommittee office, B-374 Rayburn House Office Building, Washington, D.C. 20515, to the attention of Ms. Debbie Johnson.

I appreciate your cooperation in this matter.

Sincerely,

Marilyn Lloyd

MARILYN LLOYD, Chairman
Subcommittee on Energy
Research and Production

ML:dj
Attachment

Additional Questions for Mr. Ben Rusche

Waste Act Schedule

- Why did DOE ignore the direction to prepare an "environmental assessment" for the potential sites and, at a substantial penalty to the schedule, decide to complete what is in effect, in view of its extensive detail, an environmental impact statement?

Mission Plan and Project Decision Schedule

- As any good manager knows, certain activities can be performed in parallel to avoid a delay. In this regard, what actions were taken to prepare the site characterization plans at the time you were preparing the environmental assessments? Do you agree that better planning could have resulted in a schedule for these activities to be completed in parallel through different contractors to minimize the delay?

Monitored Retrievable Storage

- Will the availability of an MRS facility substantially improve the schedule for initiating disposal in the first repository because it will enable you to build, consolidate and package spent fuel in advance of determining the suitability of the first repository site? If so, how many years will be saved by having an MRS facility as opposed to waiting and locating these facilities at the repository site?

- If the Department proposes a Monitored Retrievable Storage (MRS) facility as a complement to the repository program, wouldn't the availability of an MRS diminish the political momentum for the timely completion of the repository program considering that those States with powerplants will no longer have a spent fuel storage problem? Perhaps this is a reason to advocate consolidation and storage at the reactor site? Please comment.

Site Characterization Costs

- How much will it cost to characterize each potential repository site?

- How much would it cost to characterize a fourth site and carry it into licensing as the OTA has recommended? Why does DOE disagree with OTA's recommendation that a fourth site be characterized as an additional back-up?

EPA Standards

- The Environmental Protection Agency testified before the Subcommittee that DOE has not commented to them on the difficulty of proving compliance with EPA's proposed standards. Others have stated that because EPA's proposed standards set limits at the practical level of achievability, and because the Nuclear Regulatory Commission requires large margins of assurance that these standards will be met, DOE will find it extremely difficult to comply. Have you commented to EPA on this issue, and if not, what is your opinion on this issue?

Hanford Site

- What is the Department doing in respect to its authority under the Waste Policy Act to continue site work at the Hanford Site?

- When will you begin drilling the two-site characterization shafts? According to Section 112f of the Waste Policy Act, you could begin as soon as the environmental assessment is finalized, so why wait beyond June, 1985?

- Since this site is one of the top three, wouldn't early work at this site provide a measure of insurance that DOE will meet its schedule to complete characterization?

Relations with States

- How much money is budgeted for State and local participation in the FY 1986 budget?

- Since there are no zoning regulations in the area of the Texas site, has DOE taken any steps or is it planning to take any steps to purchase development rights from surrounding land owners to prevent adverse commercial development in the area of the repository? If yes, please explain. If not, why not?

- As you may know, the Pantex management in Texas, in the Amarillo area, allows farming on the Pantex facility property, and is a model for good relations between the Department and the local government and population. Has DOE formulated a position on farming on the repository site, and if so, has it communicated it to local farm owners? If not, when will such a policy position be considered by the Department?

- Would you summarize the present state of relationships between host States and the Department of Energy?

- If you had to characterize each State's complaints about the Department of Energy, how would you do so? Are there actions that the Department is taking to address these concerns?

- One of the States is concerned that it is not receiving the participation assistance at the level it requires to adequately participate in the program. Would you discuss this problem from DOE's perspective and identify what actions you are taking to resolve the differences?

Minority Questions for Mr. Ben Rusche

- Is DOE satisfied that the Deaf Smith site in northern Texas does not pose a threat to the farm land in the surrounding counties?

- Mr. Morrison indicated in his opening statement that he has serious concerns about who should assume liability in the event of repository or transportation contamination.

  What is DOE's view on this?

  What legal hurdles exist which prevent the Federal government from accepting absolute and strict liability?

  What changes should be made in the Price Anderson Act from DOE's point of view?

- Mr. Morrison also stated his serious concerns about extending the State comment period for the Environmental Assessments.

  Will DOE reconsider its initial decision not to extend the deadline for comment on the EAs for an additional sixty days?

  If the comment is not extended, will the comments of the States and affected Indian tribes receive detailed consideration even if they are submitted after March 20th?

  Have other States, besides Washington State, requested the deadline for comment be extended?

- We realize that DOE has worked diligently to address a number of concerns of the affected States and Indian tribes and the general public. Is this emphasis on public participation a major reason why DOE has missed some of the initial milestones outlined in the Act?

- Some geologists have expressed serious concerns about the Hanford site. We're told that the tunnels dug into the basalt rock will probably have 16 psi of air and that the surrounding water embedded in the rock is 1400 psi. Don't these numbers suggest that the natural migration of water toward the tunnels is likely?

- In a February 1985 report by the Health & Energy Institute (a public interest group affiliated with Ralph Nader's Public Citizen), a number of geologic arguments against the Hanford site are advanced. The study is entitled "Heat, High Water, and Rock Instability at Hanford," by Dr. Arjun Makhijani and Kathleen Tucker. Could you please respond to the following charges made by the report:

1) The potential for "rock bursting" at Hanford is likely and could "create a conflict between repository safety and long-term repository performance."

2) There will be "substantial seepage of hot water from the copious acquifers" above the repository.

3) Drilling and working in the basalt tunnels will be complicated by "the high rock temperatures (more than 120 degrees F.)"

4) The safety of mine workers at the Hanford site could be threatened because of "releases of methane gas contained in the water into the mine."

- In the draft Environmental Assessment for Hanford, the site is generally ranked high in environment, socioeconomic, and transportation categories and relatively low in geologic factors such as geohydrology and rock characteristics. In DOE's opinion, which of these factors is more important in site selection?

- Substantial concern has been expressed throughout the Northwest that a repository at Hanford is close enough to the Columbia River to one day contaminate the river and the region's fresh water supply. What is DOE's response to this concern?

- Substantial concern has also been expressed about transportation of the spent fuel and high-level waste to the Hanford site for ultimate disposal. The major concerns are of transportation accidents and release of radiation. What is DOE's response to these concerns?

QUESTIONS AND ANSWERS

RELATING TO FEBRUARY 26, 1985

HEARING BEFORE THE

COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION
UNITED STATES HOUSE OF REPRESENTATIVES

WITNESS:
BEN C. RUSCHE
DIRECTOR, OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
UNITED STATES DEPARTMENT OF ENERGY

WASTE ACT SCHEDULE

QUESTION 1: Why did DOE ignore the direction to prepare an "environmental assessment" for the potential sites and, at substantial penalty to the schedule, decide to complete what is in effect, in view of its extensive detail, an environmental impact statement?

ANSWER: The draft Environmental Assessments were prepared to fulfill Section 112 (b)(1)(E) of the Nuclear Waste Policy Act. The use of the term "environmental assessment" was based on the terminology in Section 112 of the NWPA, and should not be confused with terminology used in the National Environmental Policy Act of 1969. The content of the environmental assessments was largely dictated by the Act. Among other things, each environmental assessment includes an evaluation of the effects of site-characterization activities on public health and safety and the environment; a discussion of alternative activities related to site characterization that may be taken to avoid such impact; an assessment of the regional and local impacts of locating a repository; and, most significantly with regard to level of detail, an evaluation of a site against the Department's siting guidelines. The siting guidelines specify the criteria the Department will use to select sites for repositories; there are twenty major criteria, and each of these has associated with it a number of conditions that would be considered favorable or potentially adverse. Each environmental assessment must address each of over 100 of these favorable and potentially adverse conditions. These evaluations against the siting guidelines for all five sites are then summarized and compared in the last chapter of the environmental assessments in order to develop an order of preference of sites for recommendation for characterization. In conclusion, the evaluations called for by the Act to be included in the environmental assessments are, indeed, extensive and complex. The Department's draft environmental assessments reflect these requirements.

MISSION PLAN AND PROJECT DECISION SCHEDULE

QUESTION 2:	As any good manager knows, certain activities can be performed in parallel to avoid a delay. In this regard, what actions were taken to prepare the site characterization plans at the time you were preparing the environmental assessments? Do you agree that better planning could have resulted in a schedule for these activities to be completed in parallel through different contractors to minimize the delay?
ANSWER:	The development of site characterization plans and the completion of environmental assessments are two high priority activities that have and will continue to place competing demands on headquarters and project office staffs. In order to optimize the utilization of time and manpower resources in the development of site characterization plans and environmental assessments, DOE has developed plans for parallel document development. According to the Nuclear Waste Policy Act of 1982, the final environmental assessments for five sites are to be issued prior to the President's approval of three sites for characterization. Shortly after presidential approval, DOE will issue site characterization plans for those three sites. Therefore, because of the parallel nature and timing of these activities, planning is essential to assure consistency and coordination. Numerous contractors are being used by DOE headquarters and the project offices to support planning activities for these two documents. In summary, the Department has done the necessary planning and resource management to minimize the schedule impacts, realizing that SCPs must be written for only three of the five EA sites and that the recommendation is not made until the final environmental assessments are completed and the sites are selected for characterization.

MONITORED RETRIEVABLE STORAGE

QUESTION 3: Will the availability of an MRS facility substantially improve the schedule for initiating disposal in the first repository because it will enable you to build, consolidate and package spent fuel in advance of determining the suitability of the first repository site? If so, how many years will be saved by having an MRS facility as opposed to waiting and locating these facilities at the repository site?

ANSWER: Yes, the construction and operation of an integrated MRS facility would allow the Federal government to proceed with these key steps toward the disposal of wastes in advance of the NRC approval of repository operation. We believe that such an MRS facility could begin accepting spent fuel in limited quantities in 1996 and be accepting and preparing spent fuel for disposal by January 1998 date established in the Nuclear Waste Policy Act.

The authorization of this integrated MRS could also enhance the geologic repository schedule and operations. The decoupling of the receipt and packaging facility from the repository would simplify the repository surface facility design and licensing requirements, allowing them to focus on critical geologic and subsurface issues, and streamline repository operations.

Having an integrated MRS facility in operation before the repository is in operation could permit an earlier reduction of the backlog of spent fuel. It should also be noted that the disassembly, consolidation and packaging of over 200,000 spent fuel assemblies for disposal will constitute a significant portion of the overall waste disposal effort that can be decoupled from the repository.

MONITORED RETRIEVABLE STORAGE

QUESTION 4: If the Department proposes a Monitored Retrievable Storage (MRS) facility as a complement to the repository program, wouldn't the availability of an MRS diminish the political mOmentum for the timely completion of the repository program considering that those States with powerplants will no longer have a spent fuel storage problem? Perhaps this is a reason to advocate consolidation and storage at the reactor site? Please comment.

QUESTION 4: With regard to your first point, the Department is acutely aware of the need to assure that the momentum and resolve necessary for the timely completion of the repository are not diminished. Further, as has been stated many times before, we do not view nor would we propose that the integrated MRS be an alternative to geologic disposal; rather it should constitute a positive step toward and enhance geologic disposal. It will be imperative that the Executive Branch and the Congress work together to assure that the integrated MRS, or for that matter any waste program initiative, does not diminish the Nation's resolve, and , if necessary, the MRS authorization should include specific language or provisions to assure that this cannot happen.

About your second point, at-reactor consolidation and continued at-reactor storage, indeed these are feasible, safe options for meeting utility spent fuel storage requirements. It is the responsibility of the utilities to provide this storage capability until the backlog of stored fuel is completely taken care of. The integrated MRS will not affect this responsibility.

SITE CHARACTERIZATION COSTS

QUESTION 5: How much will it cost to characterize each potential repository site?

ANSWER: To provide the most responsive answer, we have estimated the cost of all the activities, with one exception, being conducted by each of the three first repository projects during the five-year site characterization phase. The one activity we have not included is the repository Title I design. This design activity would not be required for site characterization. Activities that are part of the cost estimate include, for example, waste package design, development of performance assessment models, institutional relations, and grants, as well as construction of exploratory shafts and conduct of in-situ testing. The estimate for each geologic medium is as follows:

Tuff	$630 million
Basalt	$695 million
Salt	$870 million

SITE CHARACTERIZATION COSTS

QUESTION 6: How much would it cost to characterize a fourth site and carry it into licensing as the OTA has recommended? Why does DOE disagree with OTA's recommendation that a fourth site be characterized as an additional backup?

ANSWER: We estimate that it would cost approximately $600 million to characterize a fourth site. This estimate assumes that the fourth site would be in salt. The estimate includes the cost of exploratory shaft construction and in-site testing; other geologic, hydrologic, environmental, and socio-economic site characterization activities; land acquisition; institutional relations, including grants; and regulatory activities. The estimate does not include costs for waste package development, repository design activities, or systems analyses - the work done for the first salt site is assumed to suffice for the second salt site.

The Department considers that if a site is found unsuitable during or after site characterization, the Department can proceed with a recommendation to the President of one of the other two sites as the proposed repository site.

The Department believes that the current approach of characterizing three sites provides a sufficiently high degree of assurance that it will be able to recommend a proposed repository site at the end of site characterization, and that the characterization of a fourth site is neither needed nor encouraged by the provisions of the Nuclear Waste Policy Act.

ENVIRONMENTAL STANDARDS

QUESTION 7: The Environmental Protection Agency testified before the Subcommittee that DOE has not commented to them on the difficulty of proving compliance with EPA's proposed standards. Others have stated that because EPA's proposed standards set limits at the practical level of achievability, and because the Nuclear Regulatory Commission requires large margins of assurance that these standards will be met, DOE will find it extremely difficult to comply. Have you commented to EPA on this issue, and if not what is your opinion on this issue?

ANSWER: DOE has commented to the EPA on numerous occassions regarding the possible difficulties in showing compliance with the proposed EPA Standard. Specific examples of these comments are the letter from W. A. Vaughan (DOE Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness) to the EPA on May 2, 1983, that provided written comments on EPA's proposed draft standard, and in the testimony of M.J. Lawrence (Acting Deputy Director of DOE's Nuclear Waste Policy Act Project Office) during EPA's May 12, 1983 hearing on the proposed standard. These comments stressed the unnecessary conservatism of the EPA approach, the inevitability of additional conservatism being added by the NRC and DOE's potential difficulty inconclusively demonstrating compliance with the standard given the probabilistic and very long term nature of the problem. DOE is continuing to work with the EPA to provide further comments directed toward development of a workable standard and is optimistic that DOE will be able to demonstrate compliance with such a standard.

HANFORD SITE

QUESTION 8:	What is the Department doing in respect to its authority under the Waste Policy Act to continue site work at the Hanford site?
ANSWER:	The Basalt Waste Isolation Project (BWIP) has been actively conducting site investigations at the Hanford site since well before passage of the NWPA. Under provisions of the Act, many of these investigations have continued to the present day. They include geologic mapping, geophysical surveying, drilling and logging of test wells and hydrologic monitoring. A number of studies of the suitability of basalt as a repository rock were also conducted in the Near Surface Test Facility at the Hanford site. Although no major construction activity is planned until after a site characterization plan has been issued and reviewed, BWIP will conduct surface-based investigations of site tectonics and hydrology during the coming year. With respect to site work involving the exploratory shafts, the Department has decided to treat all of the potentially acceptable sites in a similar manner.

HANFORD SITE

QUESTION 9:	When will you begin drilling the two site characterization shafts? According to Section 112f of the Waste Policy Act, you could begin as soon as the environmental assessment is finalized, so why wait beyond June 1985?
ANSWER:	Drilling of the first shaft by the Basalt Waste Isolation Project is scheduled to begin in mid 1986 with drilling of the second shaft scheduled for nine months later or early 1987. Any continuation of site characterization work at Hanford is contingent upon Hanford being selected and approved by the President as one of the three candidate sites to be characterized. Initiating shaft construction before site approval could effectively preempt the President's decision and place the other sites at a technical and scheduling disadvantage. Thus, we have decided not to begin drilling the exploratory shafts until the site is approved by the President for characterization and the site characterization plan has been issued and reviewed.

HANFORD SITE

QUESTION 10: Since this site is one of the top three, wouldn't early work at this site provide a measure of insurance that DOE will meet its schedule to complete characterization?

ANSWER: Early work at the Hanford site could provide a measure of insurance toward meeting the site characterization schedule. But that insurance would be obtained at a cost. Early site work would anticipate the President's decision to approve Hanford for site characterization. Such action would place the other sites at a disadvantage (as stated in our answer to the previous questions). In addition, if site characterization would begin at Hanford prior to completion of the site characterization plan, neither the Nuclear Regulatory Commission nor the affected State and Indian Tribes would have the opportunity to comment on the characterization activities. For these reasons we chose not to begin early site work. However, extensive surface-based site investigations such as hydrologic monitoring will continue at both our Hanford and Nevada sites.

RELATIONS WITH STATES

QUESTION 11: How much money is budgeted for State and local participation in the FY 1986 budget?

ANSWER: The FY 1986 budget request contains $13.8 million for grants to the first repository States and Indian tribes and $4.1 million for grants to the second repository States. As present, local financial support is provided through the State grants.

QUESTION 12: Since there are no zoning regulations in the area of the Texas site, has DOE taken any steps or is it planning to take any steps to purchase development rights from surrounding land owners to prevent adverse commercial development in the area of the repository: If yes, please explain. If not, why not?

ANSWER: DOE has no plans to purchase development rights to prevent commercial development in the area of the repository. DOE will purchase or lease only as much land as it needs to meet the requirements of the site ownership and control provisions in the siting guidelines and in the NRC's regulation, 10 CFR 60.121. Using this approach, DOE believes it is not necessary to purchase development rights to prevent any adverse commercial development.

RELATIONS WITH STATES

QUESTION 13: As you may know, the Pantex management in Texas, in the Amarillo area, allows farming on the Pantex facility property, and is a model for good relations between the Department and the local government and population. Has DOE formulated a position on farming on the repository site, and if so has it communicated it to local farm owners? If not, when will such a policy position be considered by the Department?

ANSWER: DOE will not permit farming within the 95 acre exploratory shaft site during site characterization, nor within the 400 acre area which would contain the repository-surface facilities during the operations period if the site is selected.

DOE has not formulated a position on farming within the controlled zone, which may extend up to 10 kilometers from the boundary of the underground facility. The purpose of the controlled zone is to designate an area around the repository from which activities that are incompatible with a repository would be prohibited. Although the exact size of the controlled zone cannot be determined until site characterization, DOE currently estimates the controlled area at the Deaf Smith site would be about 5760 acres.

DOE will develop its position on farming in the controlled zone after site characterization when it has determined whether continued irrigation and other farming activities at the site would compromise the integrity of the repository.

RELATIONS WITH STATES

QUESTION 14: Would you summarize the present state of relationships between host States and the Department of Energy?

ANSWER: Although there are legitimate concerns and differences of opinion, at present the Department is working closely with the six States and three affected Indian tribes of the first repository program and the 17 States of the second repository States to address concerns and problems. Currently, the Department provides financial assistance to those affected parties for participation in the program and for review of program documents. In addition, representatives of the States and tribes meet formally and informally with Department staff on a regular basis to keep them abreast of issues of current concern and importance.

The Department hopes that through the Section 117(c) Consultation and Cooperation provisions of the Act that affected parties will be brought into even closer communication with program staff. To date, only the State of Washington and the Yakima Indian Nation have requested that the Department negotiate a Consultation and Cooperation Agreement. Negotiations were begun in 1983. When the program enters the site characterization phase, the Department will seek to enter into negotiations with other affected first repository States and tribes in order to develop similar agreements.

RELATIONS WITH STATES

QUESTION 15:	If you had to characterize each State's complaints about the Department of Energy, how would you do so? Are there actions that the Department is taking to address these concerns?
ANSWER:	Each State seems to have its own list of particular concerns relating to cooperation, access to information, the need for longer periods of review. In general, most state criticisms center on the timely provision of information concerning the program. The Department recognizes that successful implementation of the program requires informed participation. Toward these ends, the Department has consistently sought State, Indian tribe, local government, and public involvement. For example, an extensive outreach program was developed to help inform affected parties regarding the draft environmental assessments which were issued on December 20, 1984. Over 50 public briefings were held as well as 19 public hearings. These events were attended by over 6,000 people in seven States and the District of Columbia. At the hearings, 655 people provided formal testimony. Other such outreach and information efforts are being planned to coincide with the development of major documents in the program.

RELATIONS WITH STATES

QUESTION 16: One of the States is concerned that it is not receiving the participation assistance at the level it requires to adequately participate in the program. Would you discuss this problem from DOE's perspective and identify what actions you are taking to resolve the differences?

Answer: The matter in question is presently in litigation and it would not be appropriate to comment on it at this time. To address the question generally, it should be noted that the Department has been providing grants to States to participate in program activities since 1979. In general, grant proposals are submitted to the appropriate DOE Project Office. After it is determined that the proposal is justified within the bounds set by the Nuclear Waste Policy Act and is within Department budgetary constraints, the grant is awarded after an agreement is reached through negotiations between DOE and the applicant. This process usually takes between 30 and 90 days, depending on the size and complexity of the grant proposal.

Although the Department is firmly committed to providing sufficient funds for States and tribes to participate in the program, it also has the fiduciary responsibility to ensure that program funds are distributed for activities that fall within the mandates of the Act. The Department has made every effort to be reponsive to State/tribe needs for financial assistance within those mandates.

MINORITY QUESTIONS

QUESTION 17: Is DOE satisfied that the Deaf Smith site in northern Texas does not pose a threat to the farm land in the surrounding counties?

ANSWER: The issue of impact on surrounding farmland was analyzed in the draft environmental assessments and extensive comments on the subject were received during the comment period. DOE is currently in the process of reviewing and evaluating those comments.

QUESTION 18: Mr. Morrison indicated in his opening statement that he has serious concern about who should assume liability in the event of repository or transportation contamination.

a. What is DOE's view on this?

b. What legal hurdles exist which prevent the Federal government from accepting absolute and strict liability?

c. What changes should be made in the Price Anderson Act from DOE's point of view?

ANSWER: Legal obstacles to DOE's authority to offer "absolute" liability are discussed in the enclosed memorandum of June 27, 1984, from Richard L. Hames, formerly Chief Counsel of DOE's Richland Operations Office, to Mr. Ben C. Rusche, Director, Office of Civilian Radioactive Waste Management. In essence, the Anti-deficiency Act and the Federal Tort Claims Act circumscribe the liability of the United States for personal injury or property damage.

The Price-Anderson Act authorizes the Department to provide indemnity coverage to contractors operating DOE's nuclear facilities. In its August 1, 1983, report on the Price Anderson Act, the Department stated that the Act should be amended to extend the waiver of defenses provision to potential incidents involving high-level nuclear waste or spent fuel disposal or storage.

DOE is reviewing its position on the Price Anderson Act at this time and may have other recommendations in the future.

To: O. Sulzm
Amy Lu,

United States Government **Department of Energy**

memorandum

DATE: June 27, 1984

REPLY TO ATTN OF: Richard L. Hames, Chief Counsel
Richland Operations Office

SUBJECT: Consultation and Cooperation Agreement Negotiations With the State of Washington; Liability Provisions

TO: Ben C. Rusche, Director
Office of Civilian Radioactive
Waste Management

As you know, the Richland Operations Office, for the past year, has been negotiating a consultation and cooperation agreement with the State of Washington under Section 117 of the Nuclear Waste Policy Act of 1982 (NWPA). One issue which has proven to be particularly difficult to negotiate has been the Department of Energy's (DOE) authority to assume liability for and to extend indemnities for nuclear incidents arising out of operation of a repository tor transportation of high-level radioactive waste or spent nuclear fuel to the repository.

The DOE has proposed to include provisions in the agreement which would provide to DOE contractors operating a repository and to the State the protection of "persons indemnified" under the Price-Anderson Act of 1957 (Section 170 d. of the Atomic Energy Act of 1954, as amended). Further, the DOE has stated that the liability of the United States for its own acts, as distinguished from indemnity for the acts of persons indemnified under Price-Anderson, is circumscribed by the Federal Tort Claims Act. Any indemnity extended by the Department other than pursuant to Price-Anderson would have to be expressly limited to the availability of DOE appropriations.

The State feels that the position taken by the DOE would provide inadequate protection to the State and its citizens against damages caused by a nuclear indicent arising out of repository operation or transportation of nuclear material to a repository, because of the monetary and other limitations inherent in Price-Anderson, and it has maintained this position even though we have explained the Secretary's recommendations to Congress concerning extension and coverage of Price-Anderson. The State has counterproposed that the C&C agreement contain a provision whereby the United States would assume strict and absolute liability, without regard to fault, for any such damages. The State has further asserted that Section 117 of the NWPA provides the DOE sufficient statutory authority for assumption of such liability.

It is the opinion of this office, after careful and thorough review of the matter, that under current law, the DOE cannot accede to the State's position. The Comptroller General of the United States has consistently held that indemnities extended by the United States must be made expressly subject to the availability of agency appropriations, except where they are specifically authorized by statute, in order to avoid violation of the Antideficiency Act (31 U.S.C. 1341). This view was recently confirmed in a decision found at ~~[illegible]~~2 Comp. Gen. 361 which contains an excellent review of past decisions on the
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issue. We have taken the position that the only currently existing statutory exception applicable to operation of a civilian repository is contained in the Price-Anderson Act, which together with the Federal Tort Claims Act, circumscribes the liability of the United States for personal injury or property damage. We have reviewed the provisions of Section 117 of the NWPA and the relevant legislative history and have concluded that the Act provides only for procedures to be included in a C&C agreement by which the Secretary shall assist the State in resolving the State's concerns involving questions of State liability, and that it does not provide any substantive authority, independent of the Price-Anderson and Federal Tort Claims Acts, for the DOE to assume unlimited liability for damages caused by repository activities.

The General Counsel of the Department concurs in the legal conclusion set forth in this memorandum. I will be providing a copy of this memorandum to the State of Washington negotiating team.

Richard L. Hames
Chief Counsel
Richland Operations Office

bcc: Ted Garrish
Leon Silverstrom ✓
Mike Lawrence

MINORITY QUESTIONS

QUESTION 19a: Mr. Morrison also stated his serious concerns about extending the State comment period for the Environmental Assessments. Will DOE reconsider its initial decision not to extend the deadline for comment on the EAs for an additional sixty days?

ANSWER: No. DOE does not intend to reconsider its decision to adhere to a 90-day comment period on the draft EAs. Even though the Nuclear Waste Policy Act of 1982 (the Act) does not require issuance of draft EAs for public comment, the DOE published draft EAs in the interest of expanding public participation in the repository site selection process. To aid public understanding of the draft EAs, the DOE also conducted some 50 interactive briefings in January 1985 and 19 public hearings in February 1985 in the six States containing the sites under consideration, as well as the State of Oregon. The March 20, 1985 closing date for the comment period and the subsequent comment response process will result in issuance of the final EAs and the associated nomination and recommendation of sites for characterization in early fall of this year.

After careful consideration, the Department has decided not to extend the deadline for comment on the EAs past March 20, 1985. The March 20 date already involves an extension of 30 days over the original 60 day comment period that was initially considered. The problems of some reviewers in submitting their comments on the draft EAs by the March 20 closing date are understandable.

We will consider comments received after March 20 to the extent practicable.

However, the DOE believes that a balance must be struck between providing time for public comment and the need to fulfill congressional intent that a reasonable rate of progress be maintained toward disposing of the nation's nuclear waste.

QUESTION 19b: If the comment (period) is not extended, will the comments of the States and affected Indian tribes receive detailed consideration even if they are submitted after March 20th?

ANSWER: The DOE will consider comments of States and affected Indian tribes received after March 20 to the extent practicable, consistent with the intent to recommend sites for characterization by early fall.

QUESTION 19c: Have other States, besides Washington State, requested the deadline for comment be extended?

ANSWER: The States of Louisiana, Nevada, Texas, and Utah also requested that the comment period be extended beyond March 20, 1985. However, with the exception of Nevada, these states have already submitted extensive comments to the Department on the draft EAs. Nevada has indicated its intent to provide comments by mid-April.

MINORITY QUESTIONS

QUESTION 20: We realize that DOE has worked diligently to address a number of concerns of the affected States and Indian tribes and the general public. Is this emphasis on public participation a major reason why DOE has missed some of the initial milestones outlined in the Act?

ANSWER: Yes, it has been a major reason. Since the Act was passed, the Department has emphasized public participation in program activities. This emphasis has to some extent caused schedule delays in the implementation of the Act. Some of the milestones in the early stages of the program are, from our perspective, far more important than later ones. As a result, we have felt that the investment of extra time and resources was absolutely necessary in order to ensure quality products throughout the course of the program. In this regard, we have felt it imperative that the interests of States, Indian tribes, and other affected and interested parties be considered fully at this early stage in the program's development. So while we have taken more time to accomplish some of the early milestones called for in the Act, we believe that the results have warrented such an expenditure of time and resources. We now feel that we have a strong program foundation in place -- a foundation upon which future milestones can be accomplished with confidence and clear purpose.

MINORITY QUESTIONS

QUESTION 21:	Some geologists have expressed serious concerns about the Hanford site. We're told that the tunnels dug into the basalt rock will probably have 16 psi of air and that the surrounding water embedded in the rock is 1400 psi. Don't these numbers suggest that the natural migration of water toward the tunnels is likely?
ANSWER:	The concerns expressed about a 1400 psi differential pressure are valid. Indeed, one of the test objectives of the Exploratory Shaft Facility will be to see how well the dense interior of a basalt flow impedes water inflow. The dense interiors appear to have very low hydraulic conductivities and it is this property which blocks the flow of water in the same manner as a dam. An example of flow impedance by basalt is borehole DC-3, drilled in the Reference Repository Location to a depth greater than 3,500 feet with all but the bottom 50 feet of the hole cased. The open 50 feet in the dense interior of the basalt flow had no water inflow for a period of three years.

MINORITY QUESTIONS

QUESTION 22: In a February 1985 report by the Health & Energy Institute (a public interest group affiliated with Ralph Nader's Public Citizen), a number of geologic arguments against the Hanford site are advanced. The study is entitled "Heat, High Water, and Rock Instability at Hanford," by Dr. Arjun Makhijani and Kathleen Tucker. Could you please respond to the following charges made by the report:

1) The potential for "rock bursting" at Hanford is likely and could "create a conflict between repository safety and long-term repository performance."

2) There will be "substantial seepage of hot water from the copious aquifers" above the repository.

3) Drilling and working the basalt tunnels will be complicated by "the high rock temperatures (more than 120 degrees F)."

4) The safety of mine workers at the Hanford site could be threatened because of "releases of methane gas contained in the water into the mine."

ANSWER: The concerns voiced in the report by the Health & Energy Institute are addressed in the Department's "Draft Environmental Assessment, Reference Repository Location, Hanford Site, Washington" (DOE/RW-0017, December 1984). Our response to each of those concerns is as follows:

1) The DOE is cognizant of the need to consider the potential for "rock bursting" in mine openings within the basalt flows underlying the Hanford Site. As expressed in the Draft Enviromental Assessment (EA) (pp. 6-185 to 187, 6-197 to 198),

DOE has evaluated the potential severity of the problem to the extent feasible before exploratory shaft (ES) construction. A comparison of known in situ tectonic stress conditions and rock characteristics at Hanford with several case history studies (EA, Table 6-25) and application of the empirical method of Barton, *et al., suggest that a repository in the Cohassett Flow would be classified in the "mild rock burst" category; that is, it would consist of occasional popping, spitting, and spalling of small pieces of rock from the walls and roof of a mine tunnel, as opposed to collapse of large blocks of rock. The Exploratory Shaft Facility will be the "laboratory" wherein the effects of rock bursts and their magnitude can be studied to determine repository safety and long-term repository performance.

2) The concept of a repository mined within the dense interior of a basalt flow at Hanford is based on the premise that such a rock media has very low permeability, a condition that would preclude large seepage or flow of ground-water into the mined openings. Subsurface geologic information acquired so far from vertical boreholes, drilled from the land surface into the basalt flows underlying Hanford site, tend to support this concept.

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*Barton, N., R. Lien, and J. Lande (1974), Engineering Classification of Rock Masses for the Design of Tunnel Support," Rock Mechanics, 6:4, pp. 189-236.

However, it is recognized that heterogeneous lithologic and structural conditions could provide connections between water-filled permeable zones above and below a dense interior, thus permitting movement of water through the dense interior. Special large-scale hydraulic stress tests using a system of pumping and observation wells are planned to begin in 1985 to evaluate the hydraulic characterisitcs of potential repository zones, including Cohassett flow interior, the currently proposed repository horizon.

The Exploratory Shaft Facility when constructed will serve to evaluate further the ability of the proposed repository to remain isolated from aquifers above and below the repository host rock. To minimize chances for mining into local, highly permeable anomalies, directional borehole probing will be performed ahead of excavation. As stated in the EA (p.6-197, para. 3):

> "While some water inflow into excavated openings is anticipated, the volumetric flow rate is expected to be minimal based on current knowledge."

Though the water is expected to be of appreciably high temperature, the low rate of inflow presently anticipated would minimize the potential "hot water" problem.

3) A refrigerated ventilation system is planned to mitigate high temperatures expected in the proposed repository zone. If inflow of ground-water is low, as presently anticipated by DOE, adequate cooling is expected to be readily accomplished. The Department has made preliminary studies of cooling requirements and finds them well within acceptable engineering limits.

4) Potential releases of methane along with inflowing ground-water to the repository excavations will be largely dealt with by providing adequate ventilation and dewatering to mitigate the hazard. Again, a low rate of ground-water inflow would minimize this potential hazard. Appreciably greater inflows of ground-water than currently anticipated by DOE would require appropriate increases in the mitigating measures. This issue is addressed in the EA which concludes that the expected methane conditions in the repository will not be as adverse as in many existing coal mines.

MINORITY QUESTIONS

QUESTION 23: In the draft Environmental Assessment for Hanford, the site is generally ranked high in environment, socioeconomics, and transportation catagories and relatively low in geologic factors such as geohydrology and rock characteristics. In DOE's opinion, which of these factors is more important in site selection?

ANSWER: The Department's Siting Guidelines require that post-closure factors, such as geohydrology and rock characteristics, be given primary importance, and that pre-closure factors, such as environmental quality, be given secondary importance in site selection. This assignment of importance in site selection is consistent with other sets of criteria defined by the National Academy of Sciences, the International Atomic Energy Agency, earlier programs in the United States, and with the requirements for the content of the guidelines given in Section 112(a) of the Act.

MINORITY QUESTIONS

QUESTION 24: Substantial concern has been expressed throughout the Northwest that a repository at Hanford is close enough to the Columbia River to one day contaminate the river and the region's fresh water supply. What is DOE's response to this concern?

ANSWER: The Department is very sensitive to the possibliity that material from any repository site may one day reach a fresh water supply in the accessible environment. The question of material from a repository at Hanford reaching the Columbia River is dependent upon the horizontal and vertical conductivities of the basalt flows and the direction of groundwater movement from the repository location. Studies to determine the conductivity values and direction of groundwater movement are ongoing, and efforts to define the hydrologic system will continue during site characterization. Based on our present understanding of that system, the repository will not contaminate the Columbia River.

MINORITY QUESTIONS

QUESTION 25: Substantial concern has also been expressed about transportation of spent fuel and high-level waste to the Hanford site for ultimate disposal. The major concerns are of transportation accidents and release of radiation. What is DOE's response to these concerns?

ANSWER: Safety is the highest priority of concern within DOE relating to the transportation of spent fuel and high-level waste to the Hanford site or any other selected site. The casks and the transportation equipment used in transporting these nuclear wastes will be designed and tested to the high-level of performance standards set up in NRC's regulation 10 CFR 71. These casks will also be certified by the NRC to verify that they meet the stipulated requirements. The actual transit of the waste in these casks will be done by highly-trained drivers that meet DOE, DOT and NRC requirements. The transportation equipment will be inspected in accordance with applicable DOT Regulation dealing with hazardous materials before shipment and during shipment will be subject to spot inspection by Federal and State inspectors. Although there has never been an accident in transporting spent fuel or high-level waste that caused radiological injury, extensive studies have been conducted that indicate that even in a very severe accident of this type, the risk of radiological release is low by any standard and would not be harmful to humans or animals or have lasting impacts on the surrounding environment.

In the unlikely event that a radiation release accident does occur, the Richland Operations Office has a radiological accident assistance and response team to assist in monitoring, assessment, and clean up of leakage or spillage of radiological materials. This assistance is available for immediate response upon request by local officials or any other persons observing the incident or accident. In addition, it is our intention to work with State officials to assist them with their radiological emergency response capabilities.

NUCLEAR WASTE TECHNOLOGY

QUESTION 5: Please describe what the DOE is doing to develop the information for NRC to generically approve dry storage technologies pursuant to the Waste Policy Act? Please describe your interactions with the NRC.

ANSWER: DOE's Spent Fuel Development program is currently providing NRC the information needed to generically license at-reactor dry storage of spent fuel. Generic R&D, managed by DOE, is establishing peak fuel clad temperatures and heat transfer parameters for dry storage in air, helium, and nitrogen. Cooperative demonstrations with utilities (where the utilities pay 75% of the cost) have been initiated and will result in licensed demonstrations of dry storage technologies. Prior to that time, unlicensed demonstrations at DOE's Idaho National Engineering Laboratory site will provide important design data. These activities will complete the technology base necessary for NRC to consider and provide generic licensing.

At-reactor dry storage license applications are now being processed by the NRC for the cooperative demonstrations. It is anticipated that these applications will be approved on a case-by-case basis over the next two to three years.

After a short demonstration period, which should be completed by the 1989-1990 timeframe, a sufficient data base should exist to allow NRC consideration of generic licensing for specific dry storage technologies.

A strong and effective liason is maintained with the NRC's Office of Nuclear Materials Safeguards and Security (NMSS) and Office of Nuclear Regulatory Research (NRR) to facilitate both licensing activities and generic rulemaking for spent fuel storage technologies. These interfaces with NRC have involved coordination through several different forums of R&D plans and results over the last four years in the development of spent fuel dry storage, rod consolidation, and wet storage technologies.

DOE has discussed at length with NRC means for DOE to assist in confirming the technical bases for NRC's dry storage generic rulemaking. Meetings between DOE's technical experts and the NRC staff have been held to discuss generic design rulemaking for dry storage. NRC has provided staff memoranda to DOE outlining possible NRC schedules for issuing a final rule in 1988, consistent with DOE providing NRC technical bases from development and demonstration activities for confirmation. DOE is currently working with NRC to develop the detailed technical information needs and schedules.

DOE has facilitated resolution of technical issues related to licensing dry storage and rod consolidation demonstrations at reactor sites. Through its participation in technical meetings between NRC's NMSS staff and Virginia Electric and Power Company (Vepco), Carolina Power and Light (CP&L), and Tennessee Valley Authority (TVA), DOE has provided technical information in a timely manner to resolve potential licensing issues. DOE and NRC coordinate their spent fuel R&D efforts through a technical integration group, which includes the participating utilities and DOE's technical contractors. This effort has focused R&D to resolve licensing issues. DOE and its technical contractors have met to review a supplement to the Safety Evaluation Report for GE's Morris, Illinois facility. All NRC questions were answered and the first U.S. test of a large metal dry storage cask was performed at the facility under the R&D provisions (10 CFR Part 72.35) of the existing license. NRC expects to complete their Vepco license review and documentation in September 1985. This will be the first dry storage license issued by NRC under 10 CFR Part 72.

NUCLEAR WASTE TECHNOLOGY

QUESTION 5a: Adequate program planning is a vital element in the administration of government programs. Therefore, please provide a budget chart showing the actual and projected budgets from FY 1982 through FY 1991 for the following activities:

Low-level Waste
Waste Treatment
Spent Fuel Storage Development
Alternative Disposal Concepts
Generic Methods and Supporting Studies
FUSRAP
Grand Junction Remedial Action Project
Uranium Mill Tailings
Surplus Facilities
West Valley

b. Also please provide a short list of the projected yearly goals of these programs in fiscal years 1987 through 1991.

ANSWER: a. The following budget chart reflects the actual obligations from FY 1982 through FY 1984 and projected Budget Authority from FY 1985 through 1990 for Spent Fuel Storage Development, Alternative Disposal Concepts and Generic Methods and Supporting Studies. The projected budget authority for FY 1991 will be determined during the FY 1987 Budget Process.

	Actual Obligations			Estimated Obligations			Projected Budget Authority			
Program	FY 1982	FY 1983	FY 1984	FY 1985	FY 1986	FY 1987	FY 1988	FY 1989	FY 1990	FY 1991
				- (In Millions of Dollars) -						
Spent Fuel Storage Development...	5.8	6.6	5.0	12.7	8.9	6.0	4.8	2.3	0.6	a/
Alternative Disposal Concepts....	3.9	6.0	7.5	11.3	12.5	12.7	12.8	13.0	14.0	a/
Generic Methods and Supporting Studies........................	2.5	18.1	1.5	1.8	2.3	2.2	2.1	2.1	2.1	a/
Total............	12.2	30.7	14.0	25.8	23.7	20.9	19.7	17.4	16.7	a/

a/ To be determined during FY 1987 Budget Process.

b. The anticipated yearly goals for these programs for Fiscal Years 1987 through 1991 are delineated below.

Spent Fuel Storage Development

FY 1987

- Complete licensed demonstrations of dry storage in the GNS cask at Browns Ferry.
- Issue final report on the TVA dry storage demonstration.
- Assist NUSCO in PWR rod consolidation at the Millstone spent fuel pool.
- Qualify computer codes for utility use in licensing activities.
- Complete letter report on the integrity of high burnup assembles during long-term dry storage.
- Issue topical report on cover gas specification's for long-term storage based on dry storage demonstrations.
- Continue international cooperation and Federal Interim Storage planning activities.

FY 1988

- Complete Carolina Power & Light & VEPCO cooperative dry storage demonstrations.
- Complete rod consolidation demonstrations.

- Issue topical report on results of hot cell examinations of lead test assemblies and dry storage demonstrations.
- Issue topical report on storage system integrity.
- Continue International Cooperation and Federal Interim Storage planning activities.

FY 1989 - FY 1991

- Continue International Cooperation and Federal Interim Storage Planning activities.

Alternative Disposal Concepts

FY 1987

- Complete Three-Dimensional Geophysical Mapping of 2 sites.
- Recover In Situ Heat Transfer Experiment.
- Complete Site-Specific Circulation Model.

FY 1988

- Nominate Site for Future Study and prepare a site Qualification Plan.
- Complete Deep - Sampling Geoscience Verification of 2 sites.
- Conduct hole closure emplacement Test.
- Complete Canister-Sediment Migration Analyses.
- Analyze ISHTE Experimental Data.
- Complete assessment of Far-Field Radionuclide Transport.

- o Complete Acquisition of Site-Specific Biological and Physical Oceangraphic Data.

FY 1989

- o Complete Safety Analyses
- o Recommend Legal and Institutional Systems for Subseabed Disposal Program.

FY 1990

- o Issue scientific and environmental feasibility report.

FY 1991

- o Develop and verify all units of the system model.
- o Initiate long-term in-situ experiments and pre-conceptual design.

Generic Methods and Supporting Studies

FY 1987 - 1991

- o Support the following fellowship's:
  - Nuclear Engineering, Health Physics and Radioactive Waste Management Fellowship administered by ORAU.
  - University/DOE Laboratory Cooperative Program--- Nuclear Waste Research administered by the Northwest College and University Association for Science (University of Washington/Joint Center for Graduate Study.)

  - Historically Black Colleges and Universities Radioactive Waste Management and Research Program pursuant to Executive Order 12320.
- o Participate and support nuclear waste management symposiums and seminars; for example:
  - Materials Research Society Symposium on the Scientific Basis for Nuclear Waste Management.
  - Annual University of Arizona Waste Management Symposium that is co-sponsored by DOE, American Nuclear Society, EPRI and the Radioactive Systems Committee of the American Society of Mechnical Engineers.
- o Conduct supporting studies in the field of waste management, for example,
  - National Academy of Science's Board on Radioactive Waste Management core support activities for storage, transportation and final disposal.
  - Bureau of Mines U.S. National Committee for Rock Mechanics support in the area of nuclear-waste disposal geologic storage techniques.
  - Bureau of Mines U.S. National Committee on Tunneling Technology support in the areas of storage of nuclear waste; techniques and

procedures for exploration, site analysis, rock disintegration, cavity support and materials handling; and underground construction.

- Support Small Business Innovative Research activities pursuant to P.L. 97-219.

o Cooperate and participate in international waste management activities, for example,

- International Sorption Information Retrieval System data collection and computer software generation project that aids the international nuclear waste disposal community in the management of nuclide adsorption and solubility data.
- International Program Support Office (PNL/RL) maintains a center for collection, organization, assembly and analysis, evaluation and dissemination on foreign fuel cycle and waste management activities.
- Technical Assistance to Nonnuclear Weapon States pursuant to Section 223 of NWPA.

UTILITY PARTICIPATION

QUESTION 13: This Committee has encouraged the Department to cooperate with the utility industry in its oversight of the Waste Fund program. What is your Office doing to involve the utilities in the process.

ANSWER: We are involved in a number of activities involving the utilities and initiated both by the utility industry and DOE. For example, the utility industry has established a Utility Nuclear Waste Management Group (UNWMG) comprised of 41 investor-owned and public nuclear utilities, to provide active utility oversight of the Nuclear Waste Fund program. We are cooperating fully with this group in its oversight of our activities. A full-day briefing was provided to the UNWMG in early March by our Headquarters' Office of Geologic Repositories. In addition, meetings between the UNWMG and each of our three project offices for the first geologic repository program are being arranged for May. We believe our interactions with the UNWMG will be beneficial and look forward to receiving their constructive suggestions.

The Secretary of Energy, numerous staff members of my office and I regularly participate in scientific and technical symposia and conferences sponsored by utility and industry groups to share the latest current information on program activities.

Further, in response to recommendations by a task force established by the Edison Electric Institute and made up of Chief Executive Officers to evaluate utility industry efforts that were ongoing regarding spent fuel disposal, the industry established a group known as the American Committee on Radioactive Disposal, ACORD. It is a small group made up of eight senior utility executives. The stated goal of the group is to provide utility industry input to assist the Federal Government in the development and implementation of the national nuclear waste disposal program. As Director of the Office of Civilian Radioactive Waste Management, I have been invited to meet with ACORD on several occasions and have done so.

And, in response to industry comment regarding the availability of financial records for review, we have engaged an international public accounting firm, Main Hurdman, to provide an annual audit and financial statement comparable to that found in a private business operation.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

May 14, 1985

The Honorable Marilyn Lloyd, Chairman
Subcommittee on Energy Research and Development
Committee on Science and Technology
United States House of Representatives
Washington, D.C. 20515

Dear Madam Chairman:

Attached are the responses of Mr. John Davis, Director, Office of Nuclear Material Safety and Safeguards, to questions that you submitted by letter dated March 25, 1985. These responses are intended to supplement the record of the Subcommittee's March 4, 1985 hearing on the FY86 DOE authorization request for Nuclear Waste Management Programs.

Please contact us again whenever we can be of assistance.

Sincerely,

Edward Fay

for Carlton Kammerer, Director
Office of Congressional Affairs

Attachment:
As stated

QUESTION 1. WHAT ACTIONS HAS NRC TAKEN THUS FAR TO GENERICALLY APPROVE DRY SPENT FUEL STORAGE TECHNIQUES, AS AUTHORIZED UNDER THE NUCLEAR WASTE POLICY ACT?

ANSWER.

THE NRC STAFF HAS ESTABLISHED AN APPROACH AND A SCHEDULE FOR THE RULEMAKING CONTEMPLATED BY THE NUCLEAR WASTE POLICY ACT TO PROVIDE FOR APPROVAL AND USE OF DRY SPENT FUEL STORAGE CASKS WITHOUT THE NEED, TO THE EXTENT PRACTICAL, FOR SITE-SPECIFIC LICENSING REVIEWS. THE RULEMAKING IS TO BE PATTERNED AFTER THE REGULATORY FRAMEWORK ESTABLISHED FOR CERTIFICATION OF SHIPPING CASK DESIGNS AND THE USE OF THE SHIPPING CASKS BY AUTHORIZED LICENSEES UNDER GENERAL LICENSE CONDITIONS SPECIFIED IN THE REGULATION (10 CFR PART 71). AN ADVANCE NOTICE OF PROPOSED RULEMAKING IS PRESENTLY PROJECTED FOR COMMISSION CONSIDERATION IN MID-FY 1986, FOLLOWING THE COMPLETION THIS YEAR OF STAFF REVIEWS OF THE INITIAL TOPICAL REPORTS ON STORAGE CASK DESIGNS FILED BY POTENTIAL VENDORS AND ISSUANCE OF THE FIRST LICENSE FOR USE OF DRY STORAGE CASKS BY THE VIRGINIA POWER AND ELECTRIC COMPANY (VEPCO) AT ITS SURRY NUCLEAR POWER PLANT. THE COMPLETION OF THESE ONGOING ACTIONS BY THE STAFF IS ESSENTIAL TO PROVIDE THE BASE OF EXPERIENCE FOR THE RULEMAKING EFFORT. PUBLIC COMMENTS FROM THE ADVANCE NOTICE OF PROPOSED RULEMAKING, VEPCO EXPERIENCE, AND CONFIRMATORY INFORMATION OBTAINED FROM DOE DEVELOPMENT AND DEMONSTRATION PROGRAMS WILL PROVIDE THE BASIS FOR COMPLETION OF THE RULEMAKING IN THE 1987-1988 TIME FRAME. AS INDICATED IN MR. DAVIS' TESTIMONY BEFORE THE SUBCOMMITTEE ON MARCH 4, 1985, THE PRIMARY NEED FOR THIS MODE OF SPENT FUEL STORAGE BY UTILITIES IS EXPECTED TO DEVELOP IN THE 1990'S.

QUESTION 2. THE EPA PROPOSED STANDARDS HAVE BEEN CRITICIZED AS BEING TOO STRINGENT, IN PARTICULAR BECAUSE THEY SET LIMITS AT THE PRACTICAL LEVEL OF ACHIEVABILITY. WHILE THIS ALONE IS NOT TOO OBJECTIONABLE, THE STANDARDS, IN COMBINATION WITH NRC'S REGULATORY PRINCIPLES, WHICH ARE DESIGNED TO PROVIDE LARGE MARGINS OF ASSURANCE, MAY MAKE COMPLIANCE EXTREMELY DIFFICULT FOR THE DEPARTMENT OF ENERGY. DO YOU HAVE ANY COMMENTS ON THIS CRITICISM?

ANSWER.

THE NRC STAFF AND CONTRACTORS HAVE COMPLETED EXTENSIVE, INDEPENDENT ANALYSES OF THE ACHIEVABILITY OF THE RELEASE LIMITS OF THE PROPOSED EPA STANDARDS. ON MAY 19, 1983 THE NRC FORMALLY COMMENTED ON EPA'S PROPOSED STANDARDS AND STATED, IN PART:

> THE RESULTS OF THESE ANALYSES SHOW THAT BOTH "NORMAL" RELEASES AND THE RELEASES FOLLOWING SEVERAL DIFFERENT DISRUPTIVE SCENARIOS ARE QUITE LIKELY TO COMPLY WITH THE RELEASE LIMITS OF THE PROPOSED STANDARDS. A FEW RELEASES

WHICH FAILED TO MEET THE RELEASE LIMITS WERE CAUSED BY SELECTING VERY PESSIMISTIC VALUES FROM THE INPUT DATA RANGES. THESE DATA VALUES REPRESENT CONDITIONS (E.G., LOW RADIONUCLIDE RETARDATION) WHICH WOULD GENERALLY BE REGARDED AS TENDING TO MAKE A SITE UNSUITABLE FOR REPOSITORY LICENSING. THE NRC THEREFORE CONCLUDES THAT THE PROPOSED RELEASE LIMITS ARE BOTH ACHIEVABLE AND APPROPRIATELY RESTRICTIVE TO "WEED OUT" POOR WASTE DISPOSAL SYSTEMS.

THE ANALYSES REFERRED TO ABOVE WERE BASED ON "GENERIC" RANGES OF DATA WHICH WERE CONSIDERED TO BE REPRESENTATIVE OF THE GEOLOGIC MEDIA BEING INVESTIGATED FOR POTENTIAL REPOSITORY SITES. AS SUCH, THE COMMENT WAS NOT INTENDED TO REPRESENT AN NRC OPINION REGARDING THE ACHIEVABILITY OF EPA'S RELEASE LIMITS FOR ANY SPECIFIC SITE. THE NRC DOES NOT CONSIDER IT APPROPRIATE TO RELY PRIMARILY ON A SINGLE BARRIER, EITHER ENGINEERED OR NATURAL, TO ACHIEVE HLW ISOLATION. FOR THIS REASON, THE PERFORMANCE OBJECTIVES OF 10 CFR PART 60 WERE DEVELOPED TO IMPLEMENT THE CONCEPT OF USING MULTIPLE BARRIERS FOR HIGH-LEVEL WASTE (HLW) DISPOSAL. THE MULTIPLE

QUESTION 2. (CONTINUED) - 3 -

BARRIER CONCEPT OF PART 60 AVOIDS HEAVY RELIANCE ON PARAMETERS (E.G., GEOCHEMISTRY) WHICH ARE VERY DIFFICULT TO MEASURE WITH CONFIDENCE.

PART 60 USES THE CONCEPT OF "REASONABLE ASSURANCE" TO DESCRIBE THE LEVEL OF CONFIDENCE REQUIRED TO SHOW COMPLIANCE WITH THE PERFORMANCE OBJECTIVES, INCLUDING THE OVERALL SYSTEM PERFORMANCE OBJECTIVE (I.E., COMPLIANCE WITH THE EPA STANDARD). REGARDING THE PERFORMANCE OBJECTIVES, § 60.101 STATES, IN PART, "FOR SUCH LONG-TERM OBJECTIVES AND CRITERIA, WHAT IS REQUIRED IS REASONABLE ASSURANCE, MAKING ALLOWANCE FOR THE TIME PERIOD, HAZARDS, AND UNCERTAINTIES INVOLVED, THAT THE OUTCOME WILL BE IN CONFORMANCE WITH THOSE OBJECTIVES AND CRITERIA."

IN SUMMARY, THE NRC CONTINUES TO BELIEVE THAT A MULTIPLE BARRIER APPROACH, AS IMPLEMENTED BY THE PART 60 PERFORMANCE OBJECTIVES, WILL BE REQUIRED TO DEMONSTRATE COMPLIANCE WITH THE EPA STANDARD. THE NRC HAS NOT IDENTIFIED ANY BASIS FOR BELIEVING THAT EITHER THE EPA STANDARD OR THE PART 60 PERFORMANCE OBJECTIVES WILL "MAKE COMPLIANCE EXTREMELY DIFFICULT FOR THE DEPARTMENT OF ENERGY."

William W. Berry
President and
Chief Executive Officer

Post Office Box 26666
Richmond, Virginia 23261
804 · 771 · 3193

VIRGINIA POWER

April 12, 1985

Ms. Debbie Johnson
Subcommittee on Energy Research & Production
Committee on Science and Technology
B-374 Rayburn House Office Building
Washington, DC 20515

Dear Ms. Johnson:

In response to Chairman Lloyd's letter of March 25 concerning my testimony of March 4 on the Department of Energy's authorization request for the Nuclear Waste Management Program, I am sending you answers to the six additional questions she posed.

We appreciate the Subcommittee's interest in this vital national matter and will be glad to provide any additional information that may be needed.

Sincerely,

William W. Berry

Attachment

ADDITIONAL QUESTIONS FOR MR. WILLIAM BERRY

1. Does EEI have an opinion as to whether the Monitored Retrievable Storage (MRS) facility should or should not be built?

A. We believe the MRS should be built. We would, of course, want to examine DOE's detailed study of the MRS, as required by the Nuclear Waste Policy Act, to assure ourselves that the Department's concept fulfills the purposes of the MRS.

In commenting on DOE's draft Mission Plan, UNWMG and EEI recommended that MRS siting and licensing processes be established and initiated as soon as possible. We believe that an MRS could have important advantages as part of an integrated concept to provide surge storage capacity -- to be used when reactors discharge spent fuel at a faster rate than the repository can handle -- and to coordinate spent fuel/waste handling, packaging, and transportation:

* If disposal of consolidated spent fuel is adopted, consolidation at an MRS could considerably reduce spent fuel shipment-miles. In this case, an MRS located in the eastern U. S. would complement a western repository.

* An MRS may allow aboveground spent fuel/waste handling and packaging facilities to be licensed early, thereby removing this process from the critical path for repository licensing.

* An MRS would provide an insurance policy against a delay in the repository program, enabling DOE to meet its contractual obligations to begin taking spent fuel in 1998.

2. Will the availability of an MRS diminish the political support for completing the repository program in a timely fashion, considering that the problem at the various power plants will have been solved by this MRS?

A. Any discussion of MRS options, of course, has to recognize the overriding consideration: Congress made explicit in the Act that an MRS must not be developed at the expense of the first repository.

We believe that the MRS -- not as a substitute for a permanent repository but as part of the integrated handling system described in answer to the first question -- will make the whole spent fuel/waste handling and storage process more efficient and therefore generally more attractive. In particular, the significant reduction of shipment-miles should win widespread support. The facility would also enable DOE to accept spent fuel destined for the final repository at a higher rate than would otherwise be possible. The MRS will build greater confidence, moreover, that DOE will meet its obligation to take spent fuel beginning in 1998

3. What systems studies has DOE performed to assess the transportation aspects of an MRS as an intermediate facility for spent fuel consolidation, etc.?

A. We understand that DOE is studying the transportation aspects of an MRS, but we have not had the opportunity to review the study results. We believe this question would more appropriately be answered by DOE.

4. A potential alternative to the MRS facility is at-reactor storage using either consolidated or unconsolidated fuel in containers supplied by the Department of Energy. What do you think of this option?

A. We believe storage of spent fuel at a carefully controlled central location is far preferable to storage at 50 or 60 reactor sites. The advantage of a central site will be especially strong while reactor sites are being decommissioned.

The total expense of at-reactor storage would probably outweigh the expense of an MRS, even if many reactor sites do not need additional storage capacity. There would be both economic and practical advantages, moreover, to performing spent fuel/waste handling, packaging and perhaps fuel consolidation at an MRS than at numerous reactor sites. At-reactor storage is not really an alternative to an MRS.

5. The OTA has reported to Congress that the DOE should consider selecting, characterizing and submitting an additional site for licensing as a repository to assure that a viable site is ultimately available. Do you agree with this proposal? Please comment on it.

A. Based on our review of the nine draft Environmental Assessments of the sites under consideration for the first waste repository, UNWMG and EEI believe that there is no present justification for characterization of a fourth site. DOE has indicated its selection of the five sites to be nominated for characterization. Based on the data presently available, it appears that any one of the five sites would be acceptable. The three sites that DOE plans to characterize are each in a different geohydrologic setting. The projected cost of characterizing each site has been estimated to approach one billion dollars. Instead of considering the characterization of a fourth site, DOE should attempt to reduce costs by developing a phased approach to characterization. During the characterization process, if it becomes clear that a site is clearly less preferable than the others, a reduced effort could be expended on that particular site. Thus, an answer to each geological uncertainty need not be sought at all sites.

One argument offered by others for increasing the number of sites to be characterized is premised on the need to have three acceptable sites after characterization. We disagree with this premise and believe firmly that the Act permits the President to select a repository site from those sites characterized, without the need to have determined that three sites are acceptable after site characterization.

6. What do you believe NRC's efforts should be at the present time to generically approve dry storage technologies, for example, the one you are demonstrating with DOE?

A. NRC should generically approve dry storage technologies in a manner similar to generic approval of spent fuel transportation casks. Consistent with the Act, the spent fuel storage technology should be licensed such that the only open issue in applying for a dry storage facility license would be consideration of any site specific impacts.

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

MAY 6 1985

Honorable Marilyn Lloyd
Chairman, Subcommittee on Energy
Research and Production
Committee on Science and Technology
House of Representatives
Washington, D.C. 20515

Dear Ms. Lloyd:

I have enclosed responses to the questions you submitted on March 25 which related to the Subcommittee's hearing on the FY 1986 DOE authorization request for Nuclear Waste Management Programs.

I appreciated the opportunity to appear before your Subcommittee and represent the work that is being done by the Department of the Interior in cooperation with DOE. I look forward to working with your Subcommittee and other interested parties in Congress as we work to gather the detailed scientific information that will be needed to fully implement Federal law.

Sincerely,

Bob Broadbent

Robert N. Broadbent
Assistant Secretary
for Water and Science

Enclosure

Question. The Utah sites were not tentatively selected for characterization for a number of reasons. However, it would seem that one of the two sites would be ideal in that it is near a national park and is therefore in an area that will never be commercially developed. Aside from the transient disturbance of the area during the construction and repository loading period, this potential site holds the promise of long term isolation from populations while preserving the aesthetics of the area. What do you think of these comments? Do you think that the Utah site should have been among the top three?

Answer. There is currently too little known about the site geology and hydrology to evaluate the environmental risks that the two potential repository sites in Utah may pose. However, we believe that the close proximity of these sites, the regional and areal investigations that will be required to support licensing, and the visual and air quality impact on the Canyonlands National Park could violate the very purpose of the national park designation. Accordingly, we do not believe that either of these potential sites should be among the top three.

Question. The Department of Energy seems satisfied that it can seal the repository shaft between the aquifer and the repository working level without any communication between the two during and following repository loading. Do you share this technical confidence?

Answer. Long experience with sealing between mine shafts and the host rock and in sealing between oil and gas well casings and the borehole would indicate that the necessary technology to achieve a satisfactory seal exists. The experience with mines and wells deals with a relatively short time frame. The unknown issue which remains to be addressed is whether or not the seal life is satisfactory to meet Nuclear Regulatory Commission licensing requirements.

Question. What do you consider to be the potential problems with geology at the three sites tentatively selected for characterization?

Answer. Determination of the flow of ground water into, around, and away from the repository after closure is the principal question that must be answered at each of the three sites. As DOE's recently released draft Environmental Assessments indicate, the geology and hydrology around each site present different problems that may make this determination difficult.

At the Yucca Mountain, Nevada, site, the repository would be located above the water table in volcanic rock. The downward flux of moisture in these unsaturated rocks is known to be small, but determining details of the flow and magnitude of the flux requires new and untested techniques. Exactly how much the flux might increase during future periods of heavier rainfall is a difficult question for which an exact answer will probably not be possible; however, an upper limit can probably be established. The Yucca Mountain site lies within a region in which earthquakes, fault movement, and basaltic volcanism have occurred in the geologically recent past, although not at the immediate site. The effects on a repository located above the water table of future earthquakes and fault movement may be small, but this problem needs additional study.

Large volumes of fresh water occur in aquifers above the potential repository horizon at the Hanford, Washington, site; these present potential problems during the construction phase. The nature of regional ground-water flow through the deep basalts, which are the potential host rocks at the Hanford, Washington, site has not yet been resolved. Details of the site hydrology are also uncertain because very few reliable hydrologic tests have been completed. The degree to which the basalt host rocks conduct water has not been adequately tested, and it is not known if present flow in the immediate vicinity of the repository horizon is dominately upward, horizontal, or downward. Although earthquake activity in the recent past has been very low, the area is subject to relatively high north-south stresses, which might lead to increased levels of earthquakes and faulting in the future. The coupled effects of heat and high in-situ stress may also cause problems.

The proposed repository site at Deaf Smith County, Texas, would utilize bedded salt as the repository horizon. There is at present no water known to be flowing through these rocks, and the prospects for isolation appear favorable because of the low hydraulic conductivity and low porosity of the salt. However, the number of drill holes at this site is much lower than at Yucca Mountain and Hanford. Potential problems in the salt section include the possibility of brine pockets, brine seeps, shear zones, small faults, and zones of dissolution. Only after extensive site characterization can the presence or absence of such features be confirmed. The salt beds in the Palo Duro basin are less pure than those in some other salt basins; dehydration of hydrous impurities by heat from the waste might lead to increased amounts of water in the vicinity of the waste. The combined effects of this water and high temperatures would then have to be assessed.

Question. Are any of the nine sites surveyed by the Department of Energy better than any of the others in terms of geology? If so, please explain.

Answer. There is a broad range in the level of geologic information available at the nine sites under investigation by the Department of Energy. It is a truism that as more and more information is collected the complexity of the geology at any site becomes more and more apparent. Thus we believe it is too early in the investigation history to say that any of the sites is significantly better than the others on the basis of the geology. Ultimately, any site will be complex for one reason or another on the basis of the earth-science issues which must be resolved.

Question. How many full-time equivalents does the Department of the Interior have following the repository program.

Answer. As stated by Mr. Broadbent during his testimony to the U.S. House of Representatives, Committee on Science and Technology, Subcommittee on Energy Research and Production, on March 4, 1985, the USGS activity associated with the repository program "...involves the active and continuous participation of more than 100 USGS employees, 85 of whom are involved at the Yucca Mountain, Nevada, site." In addition, the USGS dedicates approximately 30 full-time equivalents to other activities such as research review and consultation that do not directly follow the repository program but that support the program. By far the largest contribution by Interior bureaus is that of the USGS: it might be anticipated that another 10 to 15 full-time equivalents from the other Interior bureaus also follow the program. It is expected that the level of activity, and the level of full-time equivalents, for the Bureau of Mines will increase in fiscal years 1985 and 1986.

Question. About how much money is DOI planning to spend on this activity in FY 1986?

Answer. Representative of the level of funding that DOI is planning to spend in FY 1986 is the anticipated budget of the USGS. Appropriate funds to be dedicated by the USGS in FY 1986 are expected to be on the order of $4.5 million; DOE funds to finance the USGS effort as principal earth-sciences investigator at the Yucca Mountain, Nevada, site will necessarily be in excess of $10 million (the FY 1985 figure) and DOE funds to support USGS activities in both the salt and crystalline rock problems, combined, are anticipated to be about $1 million.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

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APR 24 1985

OFFICE OF
EXTERNAL AFFAIRS

Honorable Marilyn Lloyd
Chairman
Subcommittee on Energy Research
  and Production
Committee on Science and Technology
House of Representatives
Washington, D.C. 20515

Dear Chairman Lloyd:

As requested in your letter of March 25, 1985, we are submitting for the record our responses to the additional questions directed to Mr. Sheldon Meyers, who testified at your March 4, 1985 hearing on Nuclear Waste Management Programs.

If I can be of further assistance, please let me know.

Sincerely,

Jo Cooper

Josephine S. Cooper
Assistant Administrator
  for External Affairs

Enclosure

QUESTIONS FOR Sheldon Meyers
ENVIRONMENTAL PROTECTION AGENCY

Q: You mention on page 5 of your testimony that the EPA standards address the possibility that there will be direct human intrusion or geologic faulting. What does this mean for the Department of Energy in designing the repository or in proving compliance with the standards?

A: Since EPA does not normally have the authority to specify details or to direct DOE or NRC concerning any one of a number of disposal methods or designs, it means DOE must address these possibilities and their probabilities in determining the design of repositories.

Q: We understand from your testimony that the Nuclear Regulatory Commission will enforce EPA's release standards, but does EPA have any permit or licensing authority over the Department of Energy relative to the repository program? If so, please describe how you interpret this authority.

A: Once our standards are promulgated, the Agency's basic regulatory responsibilities under the Atomic Energy Act and the Nuclear Waste Policy Act are completed, although we are considering a provision through which the Agency might develop alternative standards for disposal of specific existing defense wastes if the need arises. Under the Atomic Energy Act, EPA has no requirements to issue permits or licenses for radiological aspects of the construction or operation of geologic repositories.

DOE may need to obtain permits from EPA for discharges of either liquid or airborne non-radioactive pollutants. If the repository operations should generate large enough quantities of hazardous waste, there would probably be a need for a permit under the Resource Conservation and Recovery Act. These are the major areas of EPA permitting authority; however, there may be other permits or activities in which EPA would participate but which would require consultation with EPA staff more familiar with those areas than I am.

Q: Will EPA be involved in any data acquisition activities at the potential repository sites?

A: No, EPA has no plans to be involved in data acquisition activities at the potential repository sites.

Q: You mention on page 4 of your testimony that the largest expected radiation exposures to the public from activities covered by these standards would be no more than a few millirem per year. Is this EPA's allowable limit or was this exposure determined as a result of other policy choices?

A: This statement does not represent an EPA requirement but rather our expectation resulting from technical assessments we have conducted.

Q: How was this expected exposure determined and what assumptions are made to reach this determination?

A: We estimated potential exposures from projected air emissions of several types of model facilities that might be used to manage and store high-level wastes. These included liquid high-level waste storage, waste solidification, solid waste and spent fuel storage, waste packaging, and repository emplacement of spent fuel or solidified high-level waste. For all operations except waste solidification, projected exposures were much less than one millirem/year--even using conservative assumptions. For the waste solidification facility, projected exposures were no greater than one to three millirem/year, assuming that the high-level waste was not solidified until at least five years after the fuel was discharged from the reactor.

Q: What is the average annual radiation exposure from the natural environment, and is your estimate of the largest expected exposure from the repository based upon some percentage of this natural exposure?

A: The average annual radiation exposure from the natural environment is calculated to be 77 millirems per year; the range being 57-128. This does not include exposure to the lung for which we have insufficient information to make an estimate. Our estimate of the largest expected exposure from the repository is not based upon a percentage of this natural exposure. Our estimate is based on the assessment of what can be reasonably achieved.

Q: What interactions does EPA have now, and what interactions does it plan to have with the Department of Energy relative to the repository program?

A: As we develop the environmental standards, we interact frequently with both DOE and NRC concerning technical aspects of our regulation and its implementation. Beyond this dialogue, EPA will comment on the draft environmental assessments that are now under public review as well as the environmental impact statements that are required in the process of repository site-selection.

Q: You mention on page 1 of your testimony that you expect Administrator Thomas to approve the standards for promulgation "in the next several months". Can you be any more specific as to the timetable you are following?

A: Our current planning calls for promulgation by June 30, 1985, barring unforeseen events.

Q: You mentioned on page 2 of your testimony that EPA is being sued to force the promulgation of the standards. Considering that these standards were required by law to be published by January 7, 1984, how is EPA defending its failure to act? Have there been any judicial determinations relative to this issue?

A: Under Section 121(a) of the Nuclear Waste Policy Act of 1982 (NWPA), EPA is required to promulgate standards "no later than one year after the date of enactment...for protection of the general environment from offsite releases from radioactive material in repositories." Enactment having occurred on January 7, 1983, EPA's standards should have been promulgated on January 7, 1984. Standards were proposed by EPA in December 1982 but have not been promulgated; standards are scheduled for promulgation early this summer.

Under Section 112 of the Clean Air Act radionuclides were designated as hazardous pollutants in 1979. National Emission Standards for Hazardous Air Pollutants (NESHAPs) for emissions of radionuclides from various sources, including NRC-licensees and DOE facilities were promulgated on January 17, 1985. These Clean Air Act standards apply to future waste repositories if the facilities are not regulated under 40 CFR 191 (High-Level Waste Standards). Therefore, at the moment, these NESHAPs would be applicable to air emissions of radionuclides from the activities for which standards are required under the NWPA.

There have not been any judicial determinations relative to this issue.

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